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ABSTRACT

Science and religion have been referred to as the two strongest general forces which influence humankind. This document contains the proceedings of a conference which was held to address some of the relationships and controversies surrounding these topics. Included are the texts of the major papers presented at the conference. These are: (1) "Science and Other Disciplines" (Harold I. Brown); (2) "Is Scientific Evidence Relevant to Justifying Religious Claims?" (Sherman P. Kanagy, II); (3) "Religion and Science: Fact and Faith" (John W. Klotz); (4) "Conflict, Compartmentalization, and Complementarity: Three Models for Understanding the Relationship between Science and Religion" (Sara Joan Miles); and (5) "Science in Defense of Whose God?" (Frederick A. Niedner, Jr.). The document also contains a direct transcription of the taped panel discussion and question-and-answer period, the names and addresses of the conference attendees, and a resource list dealing with science, Christianity, and pseudoscience. (TW)

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CONFERENCE PROCEEDINGS

THE RELIGION/SCIENCE CONTROVERSY

The Use and Abuse of Science in the Defense of Religion

Edited By

Dr. Sherman P. Kanagy, II
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Purdue University North Central
Westville, Indiana

עֲבָדִים בִּי בְּחֻקַּק לְד הוֹצִיא יְהוָה אֶתְכֶם
מִזֶּה וְלֹא יֵאָכֵל חָמֵץ: הַיּוֹם אַתֶּם
יֹצְאִים בְּחֹדֶשׁ הָאָבִיב: וְהָיָה כִּי־
יְבִיאֲךָ יְהוָה אֶל־אֶרֶץ הַכְּנַעֲנִי וְהַחִתִּי
וְהָאֱמֹרִי וְהַחִוִּי וְהַיְבוּסִי אֲשֶׁר נִשְׁבַּע
לַאֲבֹתֶיךָ לָתֶת לְךָ אֶרֶץ זָבַת חָלָב
וּדְבָשׁ וְעָבַדְתָּ אֶת־הָעֲבֹדָה הַזֹּאת
בַּחֹדֶשׁ הַזֶּה: שִׁבְעַת יָמִים תֹּאכַל מַצֹּת
וּבַיּוֹם הַשְּׁבִיעִי חַג לַיהוָה: מַצּוֹת יֵאָכֵל
אֶת שִׁבְעַת הַיָּמִים וְלֹא־יֵרָאֶה לְךָ חָמֵץ
וְלֹא־יֵרָאֶה לְךָ שְׂאֹר בְּכָל־גְּבֻלֶךָ:
וְהִגַּדְתָּ לְבִנְךָ בַּיּוֹם הַהוּא לֵאמֹר בַּעֲבוּר
זֶה עָשָׂה יְהוָה לִי בְּצֵאתִי מִמִּצְרָיִם:
וְהָיָה לְךָ לְאוֹת עַל־יָדְךָ וּלְזִכָּרוֹן בֵּין

$$\nabla \frac{1}{rH} = \left[\frac{1}{H} + \frac{\sum_i f_i(X_i - x_i)}{cH^2}\right] \nabla \frac{1}{r} + \frac{1}{c^2H^2} \nabla \sum_i f_i(X_i - x_i),$$

$$= \frac{1}{H^2} \nabla \frac{1}{r} + \frac{1}{c^2H^2} \nabla \Sigma f_i(X_i - x_i).$$

$$\left(\nabla \frac{1}{r}\right)_X = -\frac{1}{r^2} (\nabla r)_X = -\frac{X-x}{r^2} - \frac{X-x}{c^2H} \Sigma \frac{X_i - x_i}{r} f_i.$$

$$= -\frac{X-x}{r}\left[\frac{1}{r^2} + \frac{u_r}{c^2H}\right] = -\frac{X-x}{r^2H},$$

$$(\nabla \Sigma f_i(X_i - x_i))_X = \Sigma (X_i - x_i)(\nabla f_i)_X + \Sigma f_i (\nabla (X_i - x_i))_X,$$

$$= \frac{\partial r}{\partial X} \Sigma \ddot{f}_i (X_i - x_i) - \Sigma f_i \frac{\partial x_i}{\partial X} + f$$

A Conference Held at Purdue University North Central
Westville, Indiana, October 5, 1985

Organized and Co-ordinated by Dr. Sherman P. Kanagy, II

1986

Dr. Harold Brown

Dr. Sherman Kanagy

Dr. John Klotz

Mrs. Sara Miles

Dr. Frederick Niedner

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I would like to thank especially Mr. Kent R. Johnson, Library Director at Purdue University North Central and a person very knowledgeable in many areas, but in particular in philosophy of science, for his helpful innumerable hours of discussion in thinking out my own paper as well as in thinking out my comments on the papers of other participants in the conference. He also physically assisted in the smooth running of the event on the day of the conference, for which I am also thankful.

I also wish to thank Mrs. Viktoria Voller, Director of Non-Credit Programs at Purdue University North Central, along with her assistant Mrs. Betty Reynolds, for their many hours of help and encouragement during the preparation for the conference, as well as during the long day on Oct. 5. Also, I would like to thank Mrs. Gwen Vernich, our Math/Physics section secretary at Purdue University North Central and Mrs. Judith T. Back, Coordinator of Publicity and Publications, for their time-consuming efforts at helping me get the ads out for this event and bringing this manuscript to its final form.

I want to thank Drs. L. Edward Bednar, Chairman of the Math/Physics section and Dennis E. Lauer, Asst. Prof. of Mathematics at Purdue University North Central, for their constant encouragement of my efforts to have such a conference. Finally, I wish to thank Dr. Patrick Leonard, Vice Chancellor of Purdue University North Central, for his wise comments on the pre-publication manuscript.

INTRODUCTION.

"Whitehead has called science and religion 'the two strongest general forces which influence men.' He wrote: 'When we consider what religion is for mankind and what science is, it is no exaggeration to say that the future course of history depends upon the decision of this generation as to the relations between them." ---Ian G. Barbour, Issues in Science and Religion (Harper & Row, N.Y., 1966), p. 12, quoting Alfred N. Whitehead, Science and the Modern World (The Macmillan Co., N.Y., 1925), p. 180.

In my early efforts to attract people to this conference I got some interesting, although disconcerting, reactions from a variety of people. Some were suspicious that the topic was not of serious intellectual concern and that the effort was to have controversy for the sake of controversy. The issues examined here do have the potential of generating great heat but little light. Highly reputable journals, however, including Zygon and the Journal of the American Scientific Affiliation, are devoted to the Religion/Science Controversy. In addition, some of the world's greatest thinkers have involved themselves in speaking to these issues. Bertrand Russell wrote a book called Religion and Science and Alfred N. Whitehead, as noted above, has written on the subject, to give just a couple examples. I intended the conference to be a forum for serious intellectual dialogue on issues important to a variety of people.

One person asked me if we intended to press a particular religious perspective. Some people were unwilling to attend unless their stance on religious questions was the only one represented. A glance at the backgrounds of the speakers should have convinced them that a broad spectrum of positions was represented. Given financial and time limitations, of course, every possible view could not have its champion. I made a great effort, however, to have strong differences of perspective represented. Dr. Klotz often speaks in favor of "scientific creationism" as a fundamentalist Lutheran theologian and someone with genetics background. Dr. Niedner is a "pure" Lutheran theologian who was trained at Concordia Seminary, where Dr. Klotz teaches, yet he is on the far "left" theologically. I chose two Lutherans because I thought our nearness to the Lutheran school Valparaiso University would attract some of its faculty as well as residents of the large Lutheran population in the surrounding community. Dr. Niedner is on that faculty as well.

Another reason for two Lutherans was partly accidental. I wanted to have a "genuine" creationist, as opposed to only a theistic evolutionist or progressive "creationist" on the panel. Financial limitations forced the search for such a person to relatively near places geographically. Also, anyone who has tried to get a more well known creationist for a conference knows that fees requested are often quite large. Dr. Klotz was gracious enough to come for a realistic amount.

I originally intended the conference to deal with the specific issue of the extent to which pseudoscience, being an abuse of science, is used by Christian groups apologetically. I called Wheaton College to see if they could direct me to a person who might have some expertise in that area. I was directed to Mrs. Sara Miles of the Biology Dept. This direction seemed quite appropriate since Wheaton stands for evangelical Christianity (as I understood) and yet the biology dept. is non-creationist either entirely or mostly. I thought Sara was a good balance to Dr. Klotz in the sense that both have biology training and both are on the conservative side of Christianity, at least compared to Dr. Niedner and probably to Dr. Brown, yet they are also on somewhat opposite sides within the Christian community at least in regard to evolution and probably in other areas as well. An added advantage of Mrs. Miles was her work toward her PhD in the history and philosophy of biology at the University of Chicago. Her background complimented that of Dr. Brown, philosopher from Northern Illinois University, since his work comes mainly from a physics perspective.

Dr. Brown never made known to me his religious stance, so I cannot comment on that. I did make an effort, though, to have someone from an atheistic or agnostic position participate. I tried to do this by contacting the American Humanist Association through Dr. Paul Kurtz and a few others. Although two scholars from that organization did offer to come, they were distant geographically. With the small fee we were forced to offer our speakers, it would have been even more embarrassing to ask them to come from such distances than it already was for even the nearby ones.

I myself represented the only physical scientist of the group, my B.S., M.S., and PhD. being in astronomy. My theological perspective is probably best expressed as "conservative, evangelical, Protestant, evidentialist with some liberal leanings"! In particular, I have great misgivings concerning Martin Luther's views as well as those of neo-orthodoxy etc. on the non-evidential nature of Christian faith. Overall, my own position was in opposition to those of all the other speakers. Clearly a broad spectrum of stances on the Religion/Science Controversy were represented at PNC on Oct. 5, 1985. Overall, our goal was to help people reason out their own positions by providing pro and con evidence from a variety of perspectives.

S. Kanagy

BACKGROUNDS OF THE SPEAKERS.

Dr. Harold I. Brown of the Dept. of Philosophy of Northern Illinois University, author of Perception, Theory, and Commitment: The New Philosophy of Science (Univ. of Chicago Press, 1979) and of over 25 articles in various technical journals.

Dr. Sherman P. Kanagy,II of the Dept. of Physics of Purdue University North Central has published articles in such journals as the Astronomical Journal . He has given numerous talks to such groups as the American Physical Society on issues of religion, science, and pseudoscience and in 1982 organized and moderated "The Creation/Evolution Controversy: A Symposium on Scientific Creationism, Evolution, & Science Education" with Dr. Boyce Drummond at Illinois State University.

Dr. John W. Klotz, Director of Graduate Studies and Professor of Theology at Concordia Seminary, St. Louis. He is also a creationist, specializing in Genetics. He is author of the influential Genes, Genesis, and Evolution (1970) and more recently Studies in Creation (Concordia Publishing House, St. Louis, 1985) along with numerous other books and articles.

Mrs. Sara J. Miles of the Dept. of Biology of Wheaton College, presently PhD candidate A. B. D. in History of Science at the Univ. of Chicago. Her article "The Roots of the Scientific Revolution: Reformed Theology" appeared in the Sept. 1985 issue of the Journal of the American Scientific Affiliation.

Dr. Frederick A. Niedner, Jr., ThD, Associate Professor of Theology at Valparaiso University. He is an ordained Lutheran minister and has published numerous articles, sermons, and reviews, among which is his co-authorship with David Truemer of Keeping the Faith: a Guide to the Christian Message (1981).

SCIENCE AND OTHER DISCIPLINES

by

Harold I. Brown
Northern Illinois University

Those of you who have read both the program and my abstract know that this talk has had at least two different titles. It is now time to reveal that there have been at least two different talks, and that the one I am about to deliver has little to do with the material in my abstract. The reason for this is that since I wrote my abstract I have had a chance to read the other abstracts, and to hear some of the other talks, and I now think that I can make a contribution to this conference that is more useful than the one I originally intended to make. I am concerned with the way in which science has been talked about in parts of our discussion thus far. Dr. Niedner, in particular, has treated science as if it were a moderately complex feature of our culture, such as baseball or duplicate bridge, but no more complex than that; and we have been given the sense that the nature of science can be captured or summed up in a sentence or two. I think this is a serious mistake, and that it is pointless to attempt to discuss the relations between science and other fields unless we have a much more realistic image of science; I want to undertake that task.

The goal of saying something about science is in conformity with my abstract, but I now want to focus on one point in particular: that science develops and changes on every possible level. As a result, any succinct characterization of science that one attempts to give may characterize science at a particular time, but is not likely to capture all of science. We are accustomed to the notion that the content of science undergoes radical change, and definitions of science tend to focus on the methodology of science, rather than on its current contents. Thus the point I want to argue is that such definitions fail because the methodology of science undergoes transformations as well. Since my time is limited, I will take the most dramatic examples available to me.

One such example has already come up at this conference. Professor Niedner characterized science as an attempt to find causal relations between phenomena that we can observe with our senses and their extensions, and it was immediately pointed out that the search for causal connections is no longer a universal feature of science. There are two central theories in contemporary physics, relativity and quantum theory, and quantum theory is a noncausal theory. That is, according to quantum theory, the most fundamental events in the physical world are not caused. Note particularly that it is not being claimed that we do not yet know their causes, but rather that if quantum theory is correct, then no such causes exist. Note also that the

introduction of this noncausal theory occurred before 1930. Now the search for causal connections was indeed a universal feature of science until the advent of quantum theory. To see how central it was, we can note that the philosopher Immanuel Kant, writing in the late 18th century, not only took the search for causality to be fundamental for science, but believed that it must be successful because we in fact know that every event in nature has a cause. At the same time, Kant recognized that there is something odd in claiming that, before scientific research begins, we already know that every event is caused, and he wrote a 550 page book in order to explain how we know this. Nowhere in this book does he ask whether we know that every event has a cause, his problem is to explain how we know this. But much has happened in science since Kant's day, and one of the transformations that has occurred is that we no longer think we know that every event is caused.

Let me now turn to another part of Professor Niedner's definition, that science is concerned with items we can detect with our senses and their extensions. I want to show you that this too is no longer correct by discussing some examples from current science. I will focus on astronomy, the oldest of the sciences, and although I will be primarily concerned with research that has occurred only during the past 40 years, it will be useful to set the scene by discussing two events from 19th century physics.

The first of these was the discovery of the theory of electromagnetism by James Clerk Maxwell. One aspect of this theory interests me here: it predicts the existence of a spectrum of electromagnetic waves. Different portions of this spectrum are characterized by different wave lengths and frequencies, running from extremely short wave lengths (and high frequencies), to very long wave lengths (and low frequencies). We human beings have evolved senses which allow us to detect two small portions of this spectrum, one which we sense as light, and one which we sense as heat, but it is important to realize that these are small portions of an extremely large spectrum. In addition, note that while it has been convenient to give names to various portions of the electromagnetic spectrum, e.g., radio waves, infrared radiation, light, ultraviolet radiation, X-rays, and gamma radiation, the electromagnetic spectrum is continous with no sharp breaks to distinguish the various segments of this spectrum. The second event occurred somewhat later in the 19th century when Heinrich Hertz succeeded in producing radio waves in the laboratory, and verifying that they have properties very similar to those of light. This was the first empirical confirmation of the existence of this spectrum, and many were to follow. Now let us turn to modern astronomy.

What most people think of when they hear the term "astronomy" must now be referred to as "optical astronomy." It

is true that, for most of the history of astronomy, astronomers studied the universe by means of the information carried by light, but once it is recognized that light is only a small portion of an enormous spectrum of radiation, it becomes important to transcend the limits of optical astronomy. After all, there is no reason for believing that the information carried by the portion of this spectrum that we can detect with our eyes is the only information that is important for understanding the universe. Nor is there any reason for believing that the fact that we can detect light without instruments, or with instruments that were designed relatively early in the history of science, makes light especially important for understanding the universe. For example, the optically brightest stars have often been subjects of great interest, in part because they were taken to be the items that generated the most energy. But stars radiate throughout the electromagnetic spectrum, and once this is recognized, we can no longer take the amount of energy radiated in the optical range to be a measure of the total energy output of a star. Stars that are bright in this range may be dim in the majority of the spectrum, and stars that are optically dim may be overwhelmingly bright at different wave lengths.

We now have the ability to study the heavens throughout this spectrum. The first step came with the development of radio astronomy --- which was a direct offshoot of the development of radar --- and other forms of astronomy soon followed. X-ray astronomy had to wait a while because our atmosphere filters out X-rays, and this form of astronomy could not be pursued until we had the ability to lift X-ray telescopes above the atmosphere. But this is now well within our capability thanks to rockets and artificial satellites. Not surprisingly, these new forms of observation have introduced significant changes in our image of the universe. Not only have we found that many optically dim stars are indeed vastly brighter at other wave lengths, we have also discovered quasars, objects that put out much more energy than we had previously imagined possible. Even more striking, our image of the majestic stability of the heavens has had to undergo alteration. Kant, in one his few eloquent passages, spoke of "the starry sky above me and the moral law within me" in an attempt to express his vision of the stability of ethics. But Kant was well informed on scientific matters of his day, and if he were alive today he would have to choose a different image, because although stars are fairly stable in the optical range, they many tend to be quite variable at other wave lengths.

In addition to showing us new kinds of objects, and new features of familiar objects, the new forms of astronomy also permit us to study much more distant objects than we could study while we were limited to optical astronomy. One reason for this derives from the fact that space is filled with dust that blocks the light from distant objects, while other forms of

electromagnetic radiation, such as radio waves, pass right through. If this seems mysterious, it is no more mysterious than the familiar fact that the walls of your house, which block out light, permit the broadcasts from the local radio station to pass. In general, a material that is transparent to radiation at some wave lengths will be opaque at other wave lengths, and vice versa. Thus ordinary glass is transparent to light, and brick is opaque to light, but transparent to radio waves. Similarly, our atmosphere, which is transparent to both light and some radio waves, is, fortunately, opaque to X-rays; and interstellar dust, which is opaque to light, is transparent at other wave lengths.

Now the few examples I have mentioned were primarily concerned with changes in the content of science. Dramatic as they are, I want to return to my main concern, the fact that we are no longer limited to studying what we can observe with our senses and their extensions. Clearly, most of the electromagnetic spectrum is not within the range of our senses, and while it may be reasonable to describe optical telescopes as extensions of our senses, it is not at all illuminating to attempt to characterize the entire range of modern telescopes in this way. Let me press this point by examining another example, this time one which leaves the electromagnetic spectrum altogether.

In addition to knowing how much energy a star puts out, astronomers would also like to know how stars generate their energy. One way to study these processes is by studying the star that is nearest to us, the sun. Unfortunately, electromagnetic radiation carries only very limited information about the sun, since the electromagnetic energy from the sun that we can study is produced only at the sun's surface. In order to understand solar processes we must be able to study the solar interior, and while electromagnetic energy is produced in the interior of the sun, the photons that carry this energy are too severely disrupted in their journey through the sun to be capable of supplying us with information about what is happening within the sun. Fortunately, there is a subatomic particle known as the neutrino that is also produced by solar processes, and that can pass through the sun unscathed. Note that we are dealing here with an instance of the noncausal nature of processes involving elementary particles. If a neutrino encounters another particle in its journey from the center of the sun, it does not necessarily interact with it. There is no causal relation, but only a probability of an interaction, and for neutrinos this probability is extremely low. As a result, enormous numbers of neutrinos generated in the sun, pass through the sun into space, and can be detected by appropriate instruments. In effect, we cannot study the solar interior using electromagnetic radiation because the sun is not transparent to this radiation; we can study solar processes by means of neutrinos because the sun is transparent to neutrinos.

The experiment I want to describe, known as "the solar neutrino experiment," can be viewed as a test of the existing theories that describe current beliefs as to how the sun generates its energy. One consequence of these theories is that they predict that a certain number of neutrinos are emitted by the reactions that generate the solar energy, and the experiment aims to test this theory by measuring the number of neutrinos coming from the sun. The detector is a tank of 100,000 gallons of a cleaning fluid commonly known as carbon tetrachloride, located about a mile underground in a gold mine in South Dakota. The reason for putting the tank so far below ground is that, as was already noted, neutrinos rarely interact with matter, and they will easily pass through a mile of earth without any interactions. No other known particles can do this, and one can safely assume that any interactions that occur in the tank of cleaning fluid result from neutrinos. The material in the tank consists of a compound of carbon and chlorine, and while neutrinos rarely interact with matter, very occasionally a neutrino will interact with a chlorine atom and transform it into argon. This is convenient since argon does not form compounds with other elements under conditions such as those in the tank. As a result, any argon produced will occur in the tank as a dissolved gas, and the tank can be periodically flushed to remove this argon. The particular isotope of argon that is produced is radioactive, and has a known half-life, so the amount of argon produced --- which is very small --- can be determined by measuring the decay rate of the argon. There are several features of this experiment that are of interest to us here.

First, let us ask why this experiment was ever done in the first place. I described it as a test of the existing theory of the sun, but astronomy textbooks from the early 1960's, when the experiment was begun, generally reported that the question of the source of the sun's energy was well understood. Indeed, this was considered a solved problem. Why, then, carry out a new test of this theory? The answer to this question illustrates two important points about science. First, no matter how well supported a scientific claim may be, it will be retested and reconsidered under appropriate circumstances. Second, in order to understand this feature of science, as well as many others, we must pay much closer attention to what scientists do than to what they say. Like any other human beings, scientists may wax enthusiastic, and make exaggerated claims, even claim to have solved a problem once and for all. But this rhetoric notwithstanding, examples such as the solar neutrino experiment show quite clearly that, no matter how well supported a claim may be, if someone discovers new ways of testing that claim, the test will be carried out. And, interestingly enough, this experiment is not giving the results that were expected --- it is yielding only about one-third the number of neutrinos that were expected on the basis of existing theory. Clearly, something is wrong with the body of scientific knowledge that was accepted when the

experiment was designed, and this brings me to my second point.

The idea that any scientific claim can be falsified is closely associated with a philosophy of science that derives from the work of Karl Popper, but as Sara Miles has already noted, this notion of falsification must not be taken in a simple minded fashion (Ms. Miles put this point in a more genteel way). In particular, the surprising outcome of the experiment does not simply show that the existing theory of the sun is wrong. The reason for this is that a number of theories are actually involved in predicting how many neutrinos should be expected. In addition to the solar theory, current theories about the behavior of neutrinos must be used both to justify the claim that all neutrinos leaving the sun actually reach the earth unaltered, as well as to provide a basis for determining what percentage of the neutrinos passing through the tank will interact with chlorine atoms. Moreover, the process of extracting the argon from the tank involves some rather complex chemistry. Thus while the result of the experiment does clearly show that there is something wrong in the existing body of science, it does not pick out what that problem is; this requires more research. Still, it cannot be too strongly emphasized that such unexpected results are taken very seriously by scientists, and that the further research necessary to determine where the problem lies is in process. Let me take two examples to illustrate a very small portion of this research.

One source of difficulty lies in the means of detecting solar neutrinos. The particular detector being used is actually capable of responding only to the highest energy neutrinos produced by the sun, and in effect, this experiment only attempts to detect considerably less than one percent of the neutrinos that we believe the sun to produce. Perhaps other detectors, which respond to a wider variety of neutrinos, will show us where the problem lies. The main difficulties in building alternative detectors are money and materials. The cleaning fluid used in the present detector is plentiful and inexpensive. One of the best of the proposed alternative detectors uses a metal known as gallium, but it would require approximately one-half of the world's annual production of gallium. A second line of research generated by the outcome of this experiment turns on the neutrinos. Modern physics recognizes the existence of three different kinds of neutrinos, but the present detector only responds to one of these. But it is possible that neutrinos change from one kind to another as they travel through space, and if this turns out to be correct, then we may have an explanation of the outcome of the experiment that is consistent with the current solar theory. Note also that if it turns out that neutrinos do change in this fashion, this will have a significant impact on several fields of physics and astrophysics.

Let me turn to my third point, and return also to my main purpose in discussing this experiment. In this experiment, solar processes are studied by detecting particles for which we have no senses, and that pass through us by the millions undetected as we sit in this room. To insist that the cleaning-fluid detector is an extension of our senses is to grasp at straws in defense of a view of science that was once accurate, but is no longer relevant. Moreover, it is to grasp at straws in a way that misses a crucial point about modern developments in scientific instrumentation: our ability to study the universe has transcended the limits imposed on earlier science by the range of items we can detect with our senses. To be sure, we do use our senses when we examine the output from our instruments, but note that this output is often processed by a computer before anyone looks at it, and that it may be in the form of a graph or an image that was enhanced by a computer program. The fact that we use our eyes to read such outputs no more limits the range of items scientists can study than does the fact that we use our eyes to read a novel constitute a limit on the scope of literature. Indeed, one typical kind of output from modern astronomy will underline this comparison. If you look at published pictures that result from, say, radio astronomy, they will often be in vivid colors, but these are not colors of any actual items in the skies. Rather, color is introduced as a coding scheme in order to increase the amount of information that can be included on a two dimensional page. For example, different colors may be assigned to different velocities, and by looking at the color picture, the trained reader can "see" not only the relative locations of the items pictured, but their velocities as well, although there is nothing that looks like a velocity on the page.

Note that I have introduced a new element into my discussion --- computers. I want to talk about computers for a bit, because they have come to play a role in modern science that will lead us to another respect in which old limits on the range of science have been surpassed. In this case, we have superseded the limits imposed on us by the data processing abilities of the machine between our ears. At an earlier stage of science, we did not seek enormous quantities of information because it was beyond our capability to learn anything from that information. It is quite likely that research with limited amounts of information yielded an impoverished understanding of the universe. I want to illustrate the role that computers now play in <u>observation</u>, and to do so I will return to radio astronomy for my first example.

If you have seen pictures of locations where research is carried out using radio telescopes, then you may have noted that astronomers usually make use not of a single radio telescope, but of a number of them at one time. We do not have to go into the reasons for this, but I do want to note that it takes several radio telescopes to provide the information needed to construct

an image, and that the output from these telescopes are fed directly into a computer which synthesizes the data and generates the picture which we eventually examine. There is no way that this could be done without a computer, because there is no way that a human brain could organize and process the quantity of information coming out of the telescopes. Before the advent of computers, our ability to make use of available information was limited by the power of our brains, but we have transcended this limit.

Let me note another feature of radio astronomy. For reasons which, again, we need not go into, it is desireable to build an image using data provided by radio telescopes that are as far apart as possible. Using earth based telescopes, the best we can do is put them at opposite ends of the planet, but this would seem to raise a problem: how are you going to build the cables needed to feed the output from these telescopes into the computer? It turns out that such cables are not necessary. Each telescope can work independently of the others, because we also have accurate atomic clocks that allow astronomers to keep track of exactly when each bit of data arrived at the telescope. If all of this information is recorded on tape, the tapes can then be mailed to the computer center where the images are constructed. I mention this example for two reasons. First, because of the vital role of computers in this process, and second to emphasize a point about observation. If what comes to mind when you think of scientific observation is a picture of someone sitting in front of a microscope, then you are several decades out of date. That kind of observation is still important, but it is by no means the entire story of modern observation.

I want to take another example, this time from high energy physics, to press my point about computers. Until fairly recently, much observation in this field made use of bubble chambers, i.e., chambers in which a passing particle generated a visible track. Do not misunderstand. No one sat in front of a bubble chamber and watched the images appear. Bubble chambers run under cryogenic conditions, and are encased in steel, with high speed cameras built into the casing. A typical bubble chamber experiment will produce hundreds of thousands of photographs which must be painstakingly examined over months to determine what has been observed. Naturally, much work was done attempting to write computer programs that would free human beings from the task of examining these photographs, but bubble chambers have now been superseded as a means of carrying out observations in high energy physics. The reason for this is that physicists are often interested in studying rare events, and the more mass you have in your detector, the more of these events you are going to be able to record. A typical freon bubble chamber uses hydrogen atoms for the detector mass, and it would be preferable to use denser atoms such as iron. There are new

detectors that permit this, but when you use iron in this way, you do not get images that can be seen or photographed. Again, the output from the detector is handled by feeding it directly into a computer, which does a great deal of processing of the data before producing an output that we can read.

I want to take one more example from a very different field: mathematics. A few years ago a problem that mathematicians had been working on for centuries was finally solved. The problem is known as "the four-color problem," and it arises if you consider different possible maps that can be drawn on a plane surface. You want to color each map in such a way that no two adjacent countries will have the same color, and the question is: what is the smallest number of colors that will be sufficient for any map whatsoever? It has long been known that five colors is enough, and that three colors is too few, but the question of whether four colors was sufficient had remained unanswered. This may not seem important to a nonmathematician, but the attempts to solve this problem have probably been responsible for the invention of more new fields of mathematics than any other problem. As a result of this work, it was known that the problem can be settled by examining a finite, but large number, of mathematical items called "graphs." There are too many of these graphs to be studied by a human being, but a few years ago a powerful computer was programmed to do the job, and we now know that four colors is indeed sufficient. What is particularly interesting about this case is that we here have the first instance of a mathematical proof that has not been read through by a human mathematician.

A final example, perhaps closer to home, is a fairly new medical device known as a "CAT scan." This is a means of doing medical X-rays which permits the physician to find out about things going on inside the body that previously could only be found by exploratory surgery. Instead of taking a single X-ray, the CAT scan takes a series of X-rays from different angles and feeds the results into a computer which constructs the image that the radiologist examines. It would be difficult to find a more practical and powerful example of a case in which computers allow us to carry out observations and gather and process information that, just a few decades ago, would have been considered beyond the range of human capacity.

I have been describing some of the more dramatic ways in which characterizations of science that accurately captured the science of particular periods of its history have become irrelevant, and in which limitations on the possible range of scientific knowledge that once seemed to be imposed by human nature itself have been transcended. This suggests a rather important point that is often missed by those who come forward to talk about science, without actually studying it. There is an old fantasy according to which the contents of science may change, but its methodology remains unaltered. A much more

plausible view, and one that is in greater conformity with the actual development of science, is that as science develops, the methodology of science also develops, and that it is the people who are doing scientific research who also invent and modify scientific methods. To put the point another way, scientists are not only continually learning new things about nature, they are also learning new ways to learn about nature. How far can we expect this joint learning process to continue? I think we are simply going to have to wait and find out, but a good perspective on this question is presented in a recent article by physicist Steven Weinberg. The article is titled, "Origins," and it is a sketch of the current state of research into the origin of the universe. As one would expect from a serious scientist, most of the article is devoted to describing outstanding problems and unanswered questions, rather than announcing achieved results. Here is Weinberg's final paragraph:

> In closing, I want to go back to one more point about cosmology. You may have noticed that, despite all these brave words, I have not explained the origin of the universe. The reason, of course, is that this is a matter about which scientists still have no clear idea. We can trace the history of the present period of expansion back to its first million years, or its first three minutes, or its first ten billionth of a second, but we still do not know if time really began just a little before then, or if so, then what started the clock. It may be that we shall never know, just as we may never learn the ultimate laws of nature. But I wouldn't bet on it. (Science, 230, Oct. 4, 1985, p. 18.).

COMMENTS ON THE PAPER BY DR. BROWN.

(1) Dr. Brown remarks that "quantum theory is a noncausal theory". Although this accurately represents majority opinion among scientists, I think David Bohm and some other reputable physicists still think that causality need not be given up. See Scientific Explanation and the Causal Structure of the World by Wesley C. Salmon (Princeton Univ. Press, N.J., 1984) and The Philosophy of Quantum Mechanics by Max Jammer (John Wiley & Sons, N.Y., 1974).

(2) Dr. Brown remarks that those who regard instrumentation as extensions of our senses are "grasping at straws" to hold onto a discredited point of view. One of his main points seems to be that computers do analysis on "raw" data before our senses perceive anything. It is not clear to me, however, why the computer cannot be considered an extension of our minds, just as the detecting instrumentation might be considered an extension of our physical senses. Any modern theory of perception seems to admit that the brain processes raw sense data before the data is recognized as a "perception" by a person's mind. Our final perception of a tree is the result of an original influx of photons into our eyes which the lens inverts as an image. This image is then manipulated by our brains so that it ultimately appears "right side up."

IS SCIENTIFIC EVIDENCE RELEVANT TO JUSTIFYING RELIGIOUS CLAIMS?

by

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It is often asserted by scientists and philosophers that religious claims are not rationally justifiable by appeal to scientific evidence. The National Academy of Sciences, for example, apparently has claimed that religion is, to use the academy's words, "not subject to validation by objective criteria".[1] Thus, they argue, beliefs like so-called "scientific" creationism should not be included as alternatives to evolution in biology texts.

In a similar vein, many theologians oppose "scientific creationism" on the basis that religion is based on an irrational, non-rational, or super-rational "faith".[2] They see the evidence-based approach to rationally justifying religious claims as anathema since it would have a tendency to make the truth or falsity of Christianity decidable by evidence.[3] They unabashedly exalt in the fact that such a non-evidentially-based understanding of the nature of faith at least appears to make Christianity (and Judaism for that matter) either a personal mysticism or even a huge irrational leap.[4]

It seems very clear to me that scientific evidence has in fact strongly affected the extent to which many people have trusted the truth-claims made by their religions, most often in a negative sense.[5] Clearly, for example, there has been a turning away from fundamentalist views of scripture among intellectuals arising at least indirectly from the influence of Darwin's Theory of Evolution, the Kant-Laplace Nebular Hypothesis, and other important theories accepted by the vast majority of modern scientists. Were the changed views of these people unjustified?

Secondly, independent of one's views about the authenticity of the Shroud of Turin, it seems clear again that many people do care about what scientific evidence says about its authenticity, i.e., scientific evidence on the Shroud is treated as possible confirming evidence of the accuracy of the biblical accounts of Christ's physical resurrection. Some Catholics similarly regard other relics, healings at Lourdes, and the "Miracle at Fatima" as physical evidence confirming their "religious beliefs." The so-called "word of knowledge" experiences among Pentecostals and alleged "fulfilled Biblical prophecy" (analogous to confirmed predictions in science) among fundamentalists are seen as objective evidence supporting religious claims as well. Should these people care about such evidence?

One could, of course, insist that Christ's resurrection was not really a physical one but rather only a religious story to help us understand "spiritual" reality.[6] Denying the necessity of

a PHYSICAL resurrection, however, would seem to put one in the realm of the Gnostic heresy. Ignoring the possibility of heresy, however, various scholars do allege that the so-called "supernatural" realm, if such exists, is unsusceptible to scientific investigation almost by definition. Science, after all, in some sense presupposes naturalism, they would say.

Despite such allegations, the biblical writers never use the word "supernatural" and they, the occultists, and typical believers seldom use this trancendentalist conception of "supernatural". The supernatural is presented most often as something having "physical" features, meaning such things as visible lights, tangible substances, audible sounds, and other physically detectable[7] phenomena alleged to occur. Also, if parapsychological phenomena are a legitimate area of scientific research, one should realize that most topics in that field traditionally were regarded as "supernatural". Although there are scientists who strongly object, parapsychology has been accepted as a legitimate branch of the AAAS. In addition, even if, as some would insist, all scientific evidence goes in the direction of disconfirming the claims of parapsychology, the fact remains that some genuinely scientific studies are considered relevant to the issue by a significant portion of the scientific community.[8]

A few final questions will make my point:

Would not the following occurrences scientifically CONFIRM (not absolutely prove, not logically entail) SOME forms of religious claims (those of evidentially-oriented fundamentalists for example, e.g., biblical plenary inerrancy)?

What if the Ark of Noah is actually found?[9] What if the astronomers confirm the existence of the Star of the Magi? What if the Shroud of Turin is shown not only to be Christ's burial shroud, but also to reveal evidence of having had an inexplicable sudden pulse of powerful energy pass through it? What if biblical archeologists actually find ancient Egyptian chariots beneath a portion of the Red Sea (or the Reed Sea if one prefers) --- chariots that can be carbon dated to the time of the Exodus of Israel from Egypt? What if Robert Gentry's research on pleochroic haloes does turn out to be good evidence for an almost instantaneous formation of the earth? What if all the evidence from the values of the fundamental constants of nature clearly does point to intelligent design rather than an "anthropic principle"? What if Christ himself physically does come a second time "in power and great glory"? (Eschatological confirmation.)

OR, would not the following be similarly DISCONFIRMING?

What if someone finds skeletal remains identified by strong

evidence as those of Jesus Christ? What if geologists unearth massive evidence that a Global Flood never occurred on the earth? What if astronomers find no evidence that there ever was a missing day in history corresponding to the event of Joshua 10?[10] What if powerful evidence is found that Mt. Sinai was volcanic in the time of Moses and the events recorded in Deuteronomy were simply a superstitious misunderstanding of purely natural volcanic phenomena? What if the earth is really billions of years old? What if very strong evidence indicates that the universe arose from a quantum mechanical, acausal, probabilistic vacuum fluctuation ex nihilo? What if Adam and Eve were not historically real progenitors of the human race, but rather humans arose from a relatively gradual gradation of various types of hominids --- with no really sharp dividing line between homo sapiens and lower creatures? What if genetic studies clearly indicate that humans did not arise from a single pair of progenitors? What if the origin of life itself is traced through enormous quantities of evidence to the impersonal electrical and magnetic interactions of simple particles of matter over millions of years? ...

Would not at least some of these "what ifs" constitute scientific evidence relevant to confirming or disconfirming some forms of Christianity (fundamentalism for example)?[11] I believe they would. Scientific evidence IS relevant to justifying some types of religious claims unless one's religion is totally mystical or irrational.[12]

ENDNOTES:

[1]E.g., "New World Academy, Fundamentalists and Soviet Jews", Washington Correspondent, Nature, v.239, p. 484, (Oct. 27, 1972):

"The academy's resolution states that 'the essential procedural foundations of science exclude appeal to supernatural causes as a concept not susceptible to validation by objective criteria; and religion and science are, therefore, separate and mutually exclusive realms of human thought whose presentation in the same context leads to misunderstanding of both scientific theory and religious belief.' "

Similarly, in "Nothing in Biology Makes Sense Except in the Light of Evolution", The Amer. Biol. Teacher, v. 35, p. 125, (Mar. 1973), Theodosius Dobzhansky, noted geneticist, remarks:

"The Koran and the Bible do not contradict Copernicus, nor does Copernicus contradict them. It is ludicrous to mistake the Bible and the Koran for primers of natural science. They treat of matters even more important: the meaning of man and his relations to God. They are written in poetic symbols ..." [Are the resurrection accounts merely "poetic symbols"?]

Also note that "poetic symbols" can express information about historical, space-time events, but in a poetic manner. Once one translates these poetic versions into their historical prose equivalents one again has an overlap with the legitimate realm of the natural sciences.

Virtually no one claims that the Bible and the Koran were intended primarily to be primers of natural science, not even the creationists. What is at issue is here is whether incidental (but sometimes religiously essential) statements or implications about the natural world can be taken as relevant to the legitimacy of strong commitment to more foundational religious claims.

[2]E.g., "Faith and Fact" by The Right Rev. W. L. Greer, Nature, v. 196, # 4849, p. 1, (Oct. 6, 1962):

"The honest consideration of factual evidence on the one hand, and the haunting claims of faith on the other ...."

[Religion is dishonest and deals only with "haunting" claims?]

"Science concerns itself with fact, with the outward, the visible (or potentially visible), with the temporal; and its language is mathematics. Religion deals with faith, with the inward, the invisible, the eternal; and its language is poetry."

That God was regarded by both Hebrews and Christians as actually visible at times and as potentially visible at other times seems clear from the doctrine of the Shekinah Glory (Exodus 14, e.g.). The biblical God is not totally transcendent but immanent as well, particularly so in Christ, "in whom dwelt the fullness of the Godhead bodily." As we do not literally "see" the human mind, but only infer its existence from external manifestations of its presence by the intelligent behavior of the body in which it dwells, so in that sense "No one has seen God at any time." However, the Shekinah was regarded as so clearly a manifestation of the presence of the Deity that it was virtually equated with Him.

When you look at my body, you would normally say you are looking at Sherm Kanagy. My body is the scientifically verifiable part of "me". In a similar way, the Shekinah was the scientifically verifiable part (the physical manifestation) of the Judeo-Christian God.

Similar sentiments to those of the NAS and of Dobzhansky are expressed in Galileo's quotation of Cardinal Baronius' saying "The Holy Spirit intended to teach us in the Bible how to go to heaven, not how the heavens go."
---Gerald Holton and Stephen G. Brush, Introduction to Concepts and Theories in Physical Science (Addison-Wesley Pub. Co.,Reading, MA, 1973), p. 58.

Or, consider Rabbi Amiel Wohl's remarks from p. 57, "Religious Leaders' Views on the Theory of Evolution", A Compendium of Information on the Theory of Evolution and the Evolution-Creationism Controversy published by The National Assoc. of Biology Teachers:

"The truth of Adam and Eve stories, or any other Biblical tales, does not rise or fall on their scientific demonstrability, but rather on their moral and symbolic teaching."

How can the teaching in itself making the teaching "true"? Besides, if one can't trust the Biblical writings when they make claims that can be verified or falsified, why trust them when make unverifiable, unfalsifiable claims?

3 "What fundamentalists insist is not that the Bible must be taken literally but that it must be so interpreted as to avoid any kind of error. In order to avoid imputing error to the Bible, fundamentalists twist and turn back and forward between literal and non-literal interpretation." ---James Barr, Fundamentalism (The Westminster Press, Philadelphia, 1978), p. 40. Although Barr attacks the fundamentalists for making their views unfalsifiable, I would claim that liberals and moderates have done the same thing but in different ways. Although historical details in the Bible

are allowed to be falsifiable by the stratagem of alleging their irrelevancy, "faith" is still sacrosanct.

"With regard to creationist theories about life, we are in a peculiar position because many people are taught from childhood that there is a Creator, who is to be revered absolutely and unquestioningly. When creation theorists strive to introduce creation into the classroom as an alternative biological theory to evolution they must recognize that they are required to give creation the status of a falsifiable idea --- that is, an idea that loses any special exemption from scrutiny, that is accepted as conceivably being false, and that must be continually tested until the question is settled. A science classroom is not the place for an idea that is revered as holy."

---Richard D. Alexander, "Evolution, Creation, and Biology Teaching", A Compendium ..., p. 104.

4 Of course, some would say it is not an irrational leap, but rather a super-rational one. Although from the point of view of some supposed higher being than us such indeed may be the case, we still have to make judgments using our admittedly limited minds based on evidence actually available to us. Thus the posssibility that religious claims are super-rational is largely if not entirely irrelevant. Often such appeals to super-rationality are simply smoke-screens to avoid admitting that religious claims have in fact been falsified. Although such falsifications may turn out to be incorrect, they may nonetheless represent the wisest judgments humans can make.

In connection with this point, K. R. Johnson, a philosopher at Purdue North Central, asked whether philosophical arguments should be allowed as confirming or disconfirming evidence in evaluating religious claims. He brought up the specific historical arguments by medieval philosophers over the paradoxicality of the concept of the Trinity. Should Christians see the apparent logical paradoxes in this concept as evidence disconfirming trinitarian Christianity? My reply was yes. One must keep in mind, however, that although evidence weighing against individual religious claims can count against the claims, it does not necessarily count conclusively against them since individual claims also can be supported by the weight of evidence supporting the Christian worldview as a whole. Similarly, the scientist does not reject his theory in the face of isolated predictions that apparently are disconfirmed by available evidence, given that numerous other important tenets of the theory have been extensively confirmed. On the other hand, should more and more anomalies arise, one's suspicions should be aroused that perhaps the theory actually is being falsified.

5 "... scientists have demolished a lot of cherished religious

beliefs and have come to be regarded by many as faith-wreckers." ---Paul Davies, God and the New Physics (Simon & Schuster, Inc., N.Y., 1983), p. 5. For example, do not most modern psychologists as well as theologians believe that the biblical demonic possession "theory" of explaining certain types of aberrant psychological behavior has been falsified by the rise of scientific theories of brain disfunction and personality disorders? Davies continues (pp. 218-219, ibid.): "... it cannot be denied that science does have something to say about religious matters... Some of the major theological issues of several centuries ago (such as the location of Heaven and Hell) have been rendered meaningless [or falsified --- S.K.] by modern cosmology and our improved understanding of the nature of space and time." Finally, Davies (p. 229, ibid.): "It would be foolish to deny that many of the traditional religious ideas about God, man and the nature of the universe have been swept away by the new physics."

Admittedly, most people do not originally acquire their foundational religious beliefs by a rational weighing of evidence. Neither do scientists acquire their foundational scientific beliefs in this way. At some basic level there is a commitment made to certain presuppositions which are not rationally justified. The context of "discovery" however, is different from the context of justification. Religious beliefs do need rational justification. Many believers sense this fact and so pay attention to the evidences mentioned above.

For an interesting discussion of proposals to scientifically test the effectiveness of prayer, see "The Prayer Test" by Stephen G. Brush, American Scientist, 62, 561-563, (Sept.-Oct. 1974).

[6]I Cor. 15:14 : "and if Christ has not been raised, then our preaching is vain, your faith also is vain."

I Cor. 15:17 : "and if Christ has not been raised, your faith is worthless; you are still in your sins."

I Cor. 15:19 : "If you have only hoped in Christ in this life, we are of all men most to be pitied."

I Cor. 15:32 : " ... If the dead are not raised, Let us eat and drink for tomorrow we die."

Also, the numerous other examples of people being "raised from the dead" in Scripture clearly indicate that the Christian idea was a physical resurrection, not a "spiritual" one, as the Gnostics might claim. In the post-resurrection appearances, Christ emphasizes that he is NOT a spirit, but has flesh and bones.

7 Examples: (1) In the account of Saul on the road to Damascus in Acts 9, Saul is struck temporarily blind by an appearance of the Shekinah Glory. Physiological effects from a "supernatural" phenomena? (2) A rushing wind and cloven tongues of fire are said to have manifested the presence of the Holy Spirit at Pentecost. I thought spirits were invisible and intangible!

It is not necessary for me to argue that these events actually occurred. I'm simply arguing that the writers of the biblical scriptures had a "physical" rather than non-physical understanding of so-called "supernatural" phenomena.

8 Helmut Schmidt's PK experiments using radioactive sources as random number generators are an example. Isn't this a scientific way to test for the existence of the phenomenon of psycho-kinesis? I am quite aware that there are weaknesses in Schmidt's experimental design. For a brief discussion of these weaknesses, see p. 200, Science: Good, Bad, and Bogus by Martin Gardner (Avon Books, N.Y., 1981). Similarly, the conclusions reached by Schmidt may very well be unfounded, but that's not the point. Despite these weaknesses, the scientific nature of the experiment remains.

Were not acts of levitation without "physical" (in the common sense) mechanisms traditionally considered in the realm of "supernatural" phenomena?

Another support for my claims here is the fact that many books dealing with scientific investigations of ESP, UFOs, Psychic Healing, Pyramid Power, etc. have titles or subtitles that imply that these things involve alleged "supernatural" phenomena. A good recent example is Science and the Paranormal, subtitled Probing the Existence of the Supernatural, ed. by George O. Abell, well-known professor of astronomy at UCLA, and Barry Singer, former professor of Psychology at California State University (Charles Scribner's Sons, N.Y., 1981).

9 Of course at this point I always hear from those who will say "I could care less whether the Ark is ever found. That is not the basis of my Christian beliefs." It is probably not the BASIS of anyone's belief. That is not my point. The point is, whatever is the foundation for one's religious beliefs, it reflects on the veracity [Note that I did not say "proves" or "disproves".] of those foundational beliefs if the type of evidence mentioned above and below is indeed found. These things should matter if one is concerned with rationally justifying one's beliefs.

Both here and in my comments on the papers by Drs. Klotz and Niedner I talk about "falsifying" religious foundational claims.

I'm not saying that one "disproves" those claims, but rather that the evidences I've been discussing could give one warrant in believing that the set of foundational assumptions are not "productive" in explaining one's accumulated experiences in the world. In the language of Imre Lakatos, given a growing body of falsified non-foundational claims, one would eventually be justified in considering the set of foundational claims ("research" program) to be a "degenerating" theology. In effect, a "degenerating" theology is a falsified (in my sense) theology since one is warranted in rejecting it.

10 Note here that I'm taking N. R. Hanson's position that lack of evidence supporting a claim constitutes evidence against the claim in the sense that commitment to belief in the claim is not warranted. See "The Agnostic's Dilemma" by Norwood R. Hanson in Norwood Russell Hanson: What I Do Not Believe, and Other Essays ed. by Stephen Toulmin and Harry Woolf (D. Reidel Pub. Co., Dordrecht-Holland, 1971), pp. 303-331. I'm not saying that absence of evidence disproves the claim (logically entails its falsity), only that such absence is disconfirming (counts against the veracity of the claim) and is not neutral.

11 Does the clear evidence that the Kaaba Stone is meteoritic disconfirm a Moslem religious claim?

12 If one insists that the types of claims I'm talking about are not really "religious" claims, one would be saying that the physical resurrection of Christ is not then a "religious" claim?

By a "religious" claim I mean a claim that (1) appears in the scriptures of the religion and (2) is regarded by followers of a religion as important to be true. For most Christians (other than those insisting on plenary inerrancy), the assertion that Jesus was a carpenter is unimportant to Christianity and thus would not be a religious claim. Note that I am not saying that any and all claims made by religious people are "religious claims". I'm assuming here that the content of the religion is defined in some sense by its scriptures. Thus, for fundamentalists at least, the historicity of Noah's Flood is important to their religion since, e.g., Christ and Peter refer to it as if it really happened (See II Peter 3:6 for example). Given a fundamentalist way of interpreting scripture, the falsification of the claim that Noah's Flood actually occurred would have damaging implications for fundamentalism. Similarly, the historicity of Adam and Eve is seen as important religiously since Christ's legal genealogy (through Joseph) is traced historical person-by-historical person to Adam in the Gospels (Luke 3:23-38).

I understand that many would rather reserve the term

"religious" for those things which allegedly cannot be historically or scientifically investigated, perhaps assertions such as "God loves His people." Call what I'm talking about "para-religious claims" if one wishes. My point is not to argue semantics, but rather to defend the view that scientific evidence is relevant to religion in ways that are usually denied.

I have listed below other internal evidence that the biblical writers themselves supported an evidentially-based "faith" rather than a subjective or mystically-based one.

Some may question the necessity of actually quoting the texts as opposed to merely making reference to them. I have chosen to quote because (1) Many readers will be too lazy to look up the quote. They would thus lose the impact of its content. (2) I wanted to make points within the quotes. This is most conveniently done in the presence of the quote itself. (3) I wanted to compile a list of quoted passages supporting my position for the convenience of those who might not have the time to hunt them up.

Exodus 9:14 : [Why were the plagues sent on Egypt?] " ... that thou mayest KNOW [have physical evidence that] that there is none like me in all the earth."

Exodus 14:31: "And Israel SAW that great work [the division of the Red Sea and subsequent drowning of the Egyptians] which the Lord did upon the Egyptians: and [as a result of that evidence] the people feared the Lord, and believed the Lord [belief followed in consequence of evidence presented], and His servant Moses."

II Kings 5:8: " ... and he shall KNOW that there is a prophet in Israel." How? By the PHYSICAL EVIDENCE provided by Elisha healing Namaan (v. 14).

Although the Living Bible is not actually a translation, but rather a paraphrase, it is interesting that in paraphrasing Ps. 75:1, Kenneth Taylor writes:

"How we thank you, Lord! Your mighty miracles give proof that you care."

Here we have, if Taylor's understanding of the sense of the text is correct, a biblical writer saying that miracles [physical evidence] gave "proof" that God cares --- proof of love! Yet some theologians seem to insist that love is the paradigm-case of the unprovable.

Matt. 11:3-5: "Now when John [the Baptist] had heard in the prison the works of Christ, he sent two of his [John's] disciples,

"And said unto him [Jesus], Art thou he that should come [the Messiah], or do we look for another?

[How did Jesus explain how they would know he was indeed the Christ? By telling them to tell John, "Go deep inside yourself and FEEL that I am He?" No:] "Jesus answered and said unto them, Go and show John again those things which ye do HEAR and SEE [physically sense, not mystically feel]:"

"The blind receive their sight, and the lame walk, the lepers are cleansed, and the deaf hear, the dead are raised up, and the poor have the gospel preached to them." [Was John so weak in his faith that he needed evidence to believe that Jesus was the Christ?]

Luke 2:12: "And this shall be a SIGN [a physical evidence] to you ...".

John 3:2: "[Nicodemus to Jesus] ... we KNOW that thou art a teacher come from God [How?]: for no man can do these miracles that thou doest, except God be with him [the miracles were physical evidence confirming Christ's claims]."

John 20:30-31: "And many other signs truly did Jesus in the presence of his disciples, which are not written in this book:

"But these are written [why the accounts of miracles?], THAT YE MIGHT BELIEVE that Jesus is the Christ [the miracles are confirming evidence that Jesus is indeed the Christ --- this claim is not merely an act of subjectivistic, irrationalistic "faith"!], the Son of God [a "religious" claim]; and that believing ye might have life through his name."

Romans 1:20: "For the invisible things of him from the creation of the world are clearly seen [How? By the eyes of "faith"? No!:], being understood by the things that are made [PHYSICAL things], even his eternal power and Godhead; so that they are without excuse."

Acts 1:3: "To whom also he showed himself alive [Who cares? After all, we accept things by FAITH, not by sight, right?!] after his passion BY MANY INFALLIBLE PROOFS, being seen [physical evidence] of them forty days ..."

Acts 19:8: "Paul entered the synagogue, and over a period of three months, debated fearlessly, with persuasive ARGUMENTS [not by appeals for an irrational leap], about the kingdom of God."

Would Paul bother to debate if he thought of religious belief as arising purely from mystical insight?

I Cor. 15:5-8: "...he [Jesus after his resurrection] was seen of Cephas, then of the twelve:

"After that, he was seen of above five hundred brethern at once; of whom the greater part remain unto this present [time],

but some are fallen asleep.'
"After that, he was seen of James; then of all the apostles.'
"And last of all he was seen of me also [in the form of the Shekinah Glory on the road to Damascus] ..."

Is such a listing of sightings of the resurrected Jesus consistent with the claim that the biblical writers were unconcerned with evidence? Faith is not based on sight is it?

II Peter 1:16: "For we have not followed cunningly devised fables [Cannot fables have deep spiritual significance? Isn't Peter implying a concern with evidence?], when we made known unto you the power and coming of our Lord Jesus Christ, but [How do we know we have not followed fables? By our deeply felt mystical faith? No! Rather it is because we :] were EYEWITNESSES of his majesty. [Note that "his majesty" most likely refers to the Shekinah Glory, the visible evidence of the presence of deity, as witnessed by Peter and others on the mount of transfiguration, and not merely to Christ's body or his "glorious" teaching.]"

Elijah and the prophets of Baal: If Baal's followers had argued that they had a deep inner feeling about the existence and great power of Baal, would Elijah have been tolerant and said, "Well, to each his own. Different strokes for different folks."? Wouldn't he have argued that Yahweh is the one genuinely existing God and other "gods" are false?

I Kings 18:21: "And Elijah came unto all the people, and said, How long halt ye between two opinions? If the Lord be God, follow him: but if Baal, then follow him."

I Kings 18:24: "And call ye on the name of your gods, and I will call on the name of the Lord: and the God that answereth by fire, let him be God."

How did Elijah confirm the truth of his claim? By arguing from his own deep mystical experience of God? NO. Elijah had no aversion to allowing his beliefs to be falsifiable! The confirming evidence was a publically visible manifestation of power. For Elijah, or the writer of the stories of Elijah at least, Hebrew religion was not mystically based with the accompanying relativistic perspective but rather was evidentially based, allowing rational confirmation or disconfirmation.

The above are only a sample of almost innumerable biblical texts which support my thesis. There are a few classic texts that allegedly disconfirm my thesis. I will discuss three of the more common ones: (1) the doubting Thomas story and (2) the account of Abraham attempting to sacrifice Isaac (3) coming to faith "as a child". For more discussion of a position strongly opposed to the one I have been defending, see The Foolishness of God: The Place of Reason in the Theology of Martin Luther by Siegbert W. Becker (Northwestern Publishing House, Milwaukee, 1982).

(1) Thomas asks for physical evidence: (John 20:25): "Except I shall see in his hands the print of the nails, and put my finger into the print of the nails, and thrust my hand into his side, I will not believe."

Christ's response? "Just trust me Thomas? Feel inside Thomas that what I say is true?" No. Christ provides the evidence: (John 20:27): "... Thomas, Reach hither thy finger, and behold my hands; and reach hither thy hand, and thrust it into my side; and be not faithless, but believing."

But, you say, how does one get around verse 29? Is not Christ rebuking Thomas for his insistence on having physical evidence? (John 20:29):

"Jesus saith unto him, Thomas, because thou hast seen me, thou hast believed; blessed are they that have not seen, and yet have believed."

The prima facie evidence does seem to imply an encouragement of gullibility. Yet the wider biblical context does not support such an interpretation, as noted above, particularly in the verses immediately following the Doubting Thomas story (John 20:30-31).

I would argue that Jesus is not rebuking Thomas for seeking clear physical evidence. Rather, he is rebuking him because Thomas already had plenty of evidence to believe what Jesus was claiming. Thomas was being "hypersceptical"; the degree of his scepticism was not rationally warranted in view of the evidence already available to him from his numerous previous experiences with Christ.

In the call of Nathanael, one has Christ rebuking Nathanael for not being sufficiently sceptical. Nathanael believed on the basis of too little evidence:

(John 1:48-50): "... Jesus ... said unto him, ... when thou wast under the fig tree, I saw thee.

"Nathanael answered ... Rabbi, thou art the Son of God; thou art the King of Israel.

"Jesus ... said unto him, Because I said unto thee, I saw thee under the fig tree, believest thou? Thou shalt see greater things than these."

(2) Abraham and Isaac (Gen. 22:1-14): This story is frequently used to conclude that Abraham "believed" in the abscense of all good reason to do so. Thus, it is argued, we are to be equally gullible, since that is what faith is all about. I will simply point out again, that just as the wider context of the Doubting Thomas story shows that Thomas had plenty of evidence upon which to base a rational trust, so Abraham similarly had such evidence according to the biblical writers. For a more lengthy discussion

of this issue, see pp. 168 - 176 of Whatever Happened to the Human Race? by Francis A. Schaeffer and C. Everett Koop (Fleming H. Revell Co., Old Tappan, N.J., 1979). This reference is not to say that I support all claims made by Schaeffer and Koop of course, but I do find their discussion of the present point rather persuasive.

(3) Matt. 18:3,4: "... Verily I say unto you, Except ye be converted, and become as little children, ye shall not enter into the kingdom of heaven.'
"Whosoever therefore shall humble himself as this little child, the same is greatest in the kingdom of heaven."

It is often presumed that becoming "as little children" means being naive and gullible, trusting blindly in the claims of Christianity, just as children in their innocence often trust adults "without questioning."

My first point would be that there are many senses in which one could "become as little children." The author of Hebrews thought it a negative thing to be a "babe" in the sense of being able to handle only doctrinal "milk", rather than doctrinal "meat"(Heb. 5:13-14). Another way one could be "childlike" is by letting oneself be vulnerable to deception by "not questioning." "Foolishness is bound up in the heart of a child" (Prov. 22:15), so maybe we should let ourselves be foolish so we may be saved? One wonders why, in the remainder of verse 15 the writer of Proverbs suggests that we should drive such foolishness from children with "the rod of correction."

Indeed, there is a sense in which the writer of I Cor. 1:18-29 says that believers should seek to be "foolish." Consider these statements:

"For the preaching of the cross is to them that perish, foolishness; but unto us which are saved, it is the power of God.'
"For it is written, I will destroy the wisdom of the wise, and will bring to nothing the understanding of the prudent.'
"Where is the wise? Where is the scribe? Where is the disputer of this world? Hath not God made foolish the wisdom of this world?'
"For after that in the wisdom of God the world by wisdom knew not God, it pleased God by the foolishness of preaching to save them that believe.'
"For the Jews require a sign, and the Greeks seek after wisdom:'
"But we preach Christ crucified, unto the Jews a stumblingblock, and unto the Greeks foolishness;'
"But unto them which are called, both Jews and Greeks, Christ the power of God, and the wisdom of God.'
"Because the foolishness of God is wiser than men; and the

weakness of God is stronger than men.'

"For ye see your calling, brethern, how that not many wise men AFTER THE FLESH, not many mighty, not many noble, are called:'

"But God hath chosen the foolish things of the world to confound the wise; and God hath chosen the weak things of the world to confound the things which are mighty;'

"And the base things of the world, and things which are despised, hath God chosen, yea, and things which are not, to bring to nought things that are:'

"That no flesh should glory in his presence."

We should note here that the writer is not putting down wisdom as such, but rather "FLESHLY wisdom." Rom. 8:7 notes that the "CARNAL mind" is "enmity against God." Why is the fleshly mind at enmity with God? Because there is no evidence supporting belief and trust in God? No. Consider John 3:19,20,:

"And this is the condemnation, that light is come into the world, and men loved darkness rather than light, because their deeds were evil.'

"For every one that doeth evil hateth the light, neither cometh to the light, lest his deeds should be reproved."

I believe these thoughts (Rom. 8:7, John 3:19,20) are consistent with the understandings of modern philosophy of science. Men do not believe things merely because the evidence for them exists. They may choose not to believe because they don't want to believe. The Zeitgeist may not be right --- men are not always ready to receive certain views. Or perhaps men have presupposed a naturalistic worldview that does not allow there to be any evidence for "supernatural" phenomena? No matter what is observed, one always opts for a natural explanation, no matter how improbable? All men have a vested interest in and emotional commitments to their theories. These human factors can distort our reasoning processes, whether we are naturalists or supernaturalists.

But let us return to the original question of what "becoming as a child" meant. Does not Matt. 18:4 state rather directly in what sense one should become as children? People are to "humble themselves as children do." We should suppress our pride and our "lusts of the flesh" so that they do not distort our reasoning processes. Miracles are good physical evidence, assuming they actually occur. "But though he had done so many miracles before them, yet they believed not on him." (John 12:37) Why not? Because their eyes [of their understanding] had been blinded and their hearts [their wills and emotions] hardened. (John 12:40).

Acts 28:24: "And some believed the things which were spoken, and some believed not." Why didn't some believe? Acts 28:27: "For the heart of this people is waxed gross, and their ears are

dull of hearing, and their eyes have they closed [they do not WANT to see]; lest they should see with their eyes, and hear with their ears, and understand with their heart, and should be converted, and I should heal them."

Finally, notice the story of Lazarus and the Rich Man, Luke 16:30-31. The rich man asked to give his five brothers evidence of the place of torment by having Lazarus resurrected from the dead and going to his brothers so that they would repent and avoid it. The reply is verse 31: "... If they hear not Moses and the prophets, neither will they be persuaded, though one rose from the dead." In other words, the evidence was already sufficient to warrant belief. The real problem was not a matter of the avaiablility of evidence but of a lack of willingness to accept the implications of the evidence.

Biblical "faith" does not come merely from the application of raw intellect to data. Otherwise faith would become a "work", a reward reserved for those clever enough to figure it out. Faith comes rather from a combination of a "right heart" (involving an attitude of openness to all evidence, even evidence that does not appeal to our desires) and a "right intellect" (an intellect not chained arbitrarily to any particular worldview) applied to the data. Within the biblical worldview, such attitudes and purified intellects are unattainable except through the activity of the Holy Spirit:

I Cor. 2:14: "But the natural man receiveth not the things of the Spirit of God ... neither can he know them, because they are spiritually discerned."

Thus faith is not a work, but the unmerited gift of God.

Matt. 12:38-39: "Then certain of the scribes and of the Pharisees answered, saying, Master, we would see a sign from thee.'

"But he [Jesus] answered and said unto them, An evil and adulterous generation seeketh after a sign; and there shall no sign be given to it, but the sign of the prophet Jonas:" [But what a wopping sign that was --- the resurrection.]

Why was it evil for the scribes and Pharisees to seek a sign? I would argue that the broader N.T. context shows that it was because God knew their hearts. If no sign were given, they would use that as an excuse for disobedience and unbelief. They had already been given plenty of signs. Signs will not convince unless the heart is right. [Recall "though one rise from the dead," ...]. Yet Christ went on to give to others sign after sign because SOME would respond to the evidence with belief because their "hearts" were more yielded to the urgings of the Holy Spirit.

Have I thus thrown out all my argument for an evidentially-based faith? No. In both science and Christianity there is a point where one must decide that the evidence is sufficient to warrant commitment. All relevant evidence is never "in", thus the decision involves a "leap of faith", although it is rationally BASED. I would emphasize, however, that this leap should not be made at the level of individual facts ("I believe Jerusalem exists because the Bible says so.") but rather at the level of foundational presuppositions ("Human reason is a reliable guide to understanding the meaning of the language used by the scripture writers.").

A biblical view of human nature suggests that we want the rewards without the discipline, without obedience. We want to remain in our sin, yet have the rewards of those whose sins are forgiven. We want supernatural power without holiness. We love darkness more than light. Thus the "natural man" opposes the gospel. Unlike many situations in science, we have a strong vested interest in not believing. This opposition to certain interpretations of the evidence must be overcome by the activity of the Holy Spirit, according to the biblical writers.

But, some will still ask, were not miracles and other physical evidence given only for those who were infantile in their faith? There is a sense in which this is true. Certainly unbelievers are "infantile in their belief" --- in fact, they are not even "born" as believers yet. How should infantile believers become mature believers? Hopefully by experiences that accumulate confirming evidence for their views. Once one becomes a mature believer ,i.e., once one's views are well-founded in evidence, it would be excessively sceptical and irrational to continue to ask for more and more evidence before being willing to make a commmitment --- to treat the views at least as a "working hypothesis." One still keeps an eye open for the accumulation of falsifying evidence even then. After all, one may have been roped into a "cult" or simply false religion.

The same thing happens in science. Originally, most scientists did not believe that the earth orbited the sun. As evidence accumulated confirming the Copernican theory against the Ptolemaic theory, some people accepted the Copernican view. Today, nearly all scientists accept as fact, as "truth", that the earth does indeed orbit the sun. Scientists work as if it is truth. The evidence available warrants commitment in their judgment.

I understand that what constitutes evidence is always judged within the context of a given paradigm and that the transition from belief in the Ptolemaic theory to belief in the Copernican theory is sometimes argued to be a "paradigm shift" which depended on some things other than merely the accumulation of "evidence." On the other hand, something must warrant paradigm shifts (contra

Feyerabend) and I would call that something "evidence." Few scientists today would seriously consider the claim that the Ptolemaic model is "just as good as" the Copernican model and the way they would justify their lack of consideration would be on the basis of what they would call "evidence." The observed phases of Venus, for example, simply is inconsistent with the Ptolemaic model. Many similar anomalies along with philosophical criteria such as aesthetic beauty, Occam's Razor, etc. convince most scientists that Ptolemaic theory is dead. Note that aesthetic beauty is treated as evidence in favor of a theory by most modern theoreticians.

The idea of "nested" paradigms may be helpful here. I think that even people working within the Ptolemaic view would have found the phases of Venus as disconfirming had they observed them. Both Ptolemaists and Copernicans would agree on what constituted evidence in that regard. How could they do this if they were operating under different paradigms? They could do it because there was a broader paradigm which told them what constituted confirming and disconfirming evidence, at least to some extent. Both groups were working within the same broader paradigm.

RELIGION AND SCIENCE: FACT AND FAITH

by

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Our western religions and science have a great deal in common. To suggest that religion is based on faith and science is based on fact is to misunderstand both religion and science. To begin with, both religion and science operate with a series of identical presuppositions. These presuppositions are assumptions for which proof is not presented and for which proof is impossible. Science and Judeo-Christianity share common presuppositions. Both assume the existence of other people, that there is a real world out there as well as within the individual. They also assume that space is three dimensional and describe things in terms of three dimensional space. This has always been rather interesting to me since as a matter of fact the image that falls on the retina of the eye is two dimensional and is actually turned upside down. Still we see things in three dimensions and describe them in this way, and this is true of both science and religion.

Both science and religion assume that the existence of objects is independent of the presence of the observer. The chairs in another room are still there even though there is no one to observe them. Once more there is a reality "out there."

The particular presupposition which is most important to modern science and which is assumed by both science and our Judeo-Christian faith is the orderliness and uniformity of nature. Modern science developed out of a Judeo-Christian background since our Judeo-Christianity postulates a God who operates in an orderly and uniform way. Modern science operates on this assumption and could not have developed out of religious or philosophical background where the gods were capricious, where they changed the rules. Christianity postulates an orderliness in nature. It assumes that God ordinarily works through the natural laws which he established at creation.

What about the view that science and religion take of the world "out there"? I would insist that science and religion are supplementary not complementary. There are areas of common interest to both science and religion. They are not talking about the same subjects from entirely different points of view. The concept of "supplementary" and "complementary" can best be illustrated by saying that science and religion represent two circles. While they do not coincide, they overlap and the area of overlapping represents an area in which both have an interest. This is describing the two as supplementary. To say "complementary" is to postulate two separate circles which do not overlap at all. This is the point of view illustrated in the parable of the blind men describing the elephant. This view also suggests that religion has nothing to do with everyday

life.

In studying the relationship of religion and science the nature of religious language must be considered, for some of the problems that have developed between science and religion have been due to the attempt to equate the language of the Bible with exact scientific language. Religious language is common sense, everyday language. This is the language which we find in our daily newspaper. For instance, our daily newspaper speaks of "sunrise" and "sunset". This is Ptolemaic language but we would hardly argue that the fact that it is used in our daily newspaper indicates that the editor supports the Ptolemaic model rather than the Copernican model of the solar system. There is good reason for this, for scientific language chnages, but common sense, everyday language does not. At least some of the problems that have arisen between religion and science have been due to attempts to equate biblical language with scientific language. This was the problem involved in much of the Copernican controversy and it is also one of the problems with Darwinism when the "kinds" of Genesis are equated with biological species. When we deal with biblical statements regarding the natural world, we need to ask ourselves how Mr. Average Man would understand a biblical statement if it appeared in a newspaper and how he would express religious truths in newspaper language.

It is important to recognize that science limits itself in the areas of reality with which it deals. It deals with the phenomena which can be observed by the sense organs or by extensions of the sense organs. It is not thereby denying the reality of the supernatural; it is simply saying that in this discipline, science, we will deal only with phenomena which can be observed by the sense organs. We might represent the whole of reality by a large circle and indicate that science represents a smaller circle within the larger circle of reality. The scientist by limiting himself is not denying the reality of the supernatural, though some individuals might jump to the conclusion that only that is real which is within the bounds of their discipline.

In this connection I find Eddington's fishnet particularly helpful. He describes science as the casting of a fishnet into a pond. The fishnet, the scientific method, has a two inch mesh; it limits itself to that aspect of reality which can be examined by the sense organs. The scientist is the fisherman, he casts the net into the pond of reality and draws it into shore. He then sorts out and arranges his catch and attempts to classify it. Once he has done this he seeks by deduction to reach certain conclusions. One conclusion that he may be tempted to reach but which would be incorrect is that there are no fish under two inches in this pond. He will have found none but that is because he is fishing with a net which has two inch mesh, and fish smaller than two inches will be slipping through the net. So the scientist using the scientific method which limits itself to that

area of reality which can be apprehended by the sense organs dare not claim that there is no reality outside the realm of science.

In this connection it should be pointed out that one of the problems of the theory of evolution is that the theory must invoke the supranatural. It is a generally accepted principle of physics that matter/energy can neither be created nor destroyed. There is no scientific explanation for the origin of matter/energy and the scientist must make a supranatural assumption to explain its existence. It does no good to say that this is a philosophical rather than a scientific problem; that to my way of thinking is a cop-out.

Similarly the scientist must seek a supranatural explanation for the origin of life. Today it is an axiom of biology that all life comes from life. The idea of "spontaneous generation" has been discredited: indeed we ridicule those who were naive enough to postulate that mud could turn into worms and frogs and that decaying grain could generate baby mice.

Yet the fact of the matter is that the evolutionist must postulate the origin of living things from non-living things in a supranatural way. I am certainly well acquainted with some of the experiments that have been carried on that are reported to explain the origin of life. But the fact of the matter is that this research does not even begin to suggest a way in which non-living matter could become alive. It suggests the origin of some very simple substances which play a role in living things.

It is clear then that religion does not deal merely with matters of faith and science with fact. Science too turns to supranatural explanation and religion does concern itself with facts.

In considering the scientific method we need to recognize that science deals with two "things" and that these should be carefully distinguished. First of all science deals with facts, its data, which it gathers by means of the sense organs and then it deals with conceptual schemes, explanations for the observations which it has made. In the area of the natural, religion too depends on the observation of the sense organs, and as a matter of fact, science and religion rarely disagree on the data. When these disagreements occur they should be easily settled. It is in the area of conceptual schemes, explanations, where disagreement occurs between science and religion. Thus in studying a fossil footprint there is no disagreement regarding the observation itself. The disagreement comes in the interpretation of whether this structure is a dinosaur footprint or a footprint of another organism, whether it is a moccasin footprint or a blurred animal footprint.

In connection with observation it should be pointed out that

the genius of the modern scientific method rests on experimentation. The Greeks did little experimentation; they depended largely on rationalizations. Their approach was primarily deductive rather than inductive. Because they limited themselves in this way the amount of progress they made was also restricted. Modern science using experimentation has been able to move forward rapidly.

Yet experimentation is possible only with phenomena on our time level. And consequently science does not have the validity and reliability in dealing with the past and future that it has in dealing with the present. When it deals with the past and the future its findings are indeed "interesting conjectures", but they do not have the reliability and validity of conclusions regarding phenomena which we can examine on our time level by means of experimentation. I am not suggesting that explanations dealing with past and projections into the future have no value; what I am saying is that they do not have the validity and reliability of conclusions regarding phenomena on our time level.

It is not difficult to point to predictions to the future which have proven to be wrong. The director of the U.S. patent office, Charles H. Duell, said in 1899 "Everything that can be invented has been invented." He saw no future for American engineers and inventors. Robert Millikan, a Nobel prize winner in physics, said in 1923 "There is no likelihood that man can ever tap the power of the atom." And in 1895 Lord Kelvin, president of the Royal Society, said, "Heavier than air flying machines are impossible." We need only to examine predictions made in 1970 of life in 1980 to see how difficult predictions of the future can be. The world of 1980 was different from the predictions that had been made only ten years prior to this time.

Often the scientist will extrapolate back into the past or foreward into the future. But such extrapolations can lead to ridiculous conclusions. Mark Twain in his "Life on the Mississippi" wrote "In the space of 176 years the lower Mississippi has shortened itself 242 miles. This is an average of a trifle over one mile and a third per year. Therefore any calm person, who is not blind or idiotic, can see that in the old Oolitic Silurian period just a million years ago next November, the lower Mississippi was upward of 1,300,000 miles long and stuck out over the Gulf of Mexico like a fishing rod. And, by the same token, any person can see that 742 years from now the lower Mississippi will be only a mile and three quarters long, and Cairo in New Orleans will have joined their streets together and will be plodding comfortably along under a single mayor and mutual board of alderman."

Science is not as objective as it often claims. Scientists,

too, show a vehemence of conviction and a pride of authorship. They stick by the party line. Science is conservative; scientists oppose innovations, new explanations, in science. It is not true that they quickly embrace new ideas when the data are presented to them. Rather they find themselves defending generally accepted ideas and opposing the suggestions of neophytes in the field. They have a vested interest in the theories which they have espoused. Copernicus did not publish his ideas until he was on his deathbed because he feared the ridicule and opposition of the scientists of the day. Emotions play an important part in science. It should also be pointed out that science does not always move forward. Sometimes it moves backwards. There are times when a theory is rejected only to be reconstituted. The essence of the Copernican theory was suggested by Aristarchus of Samos in 281 B.C. He suggested a heliocentric system and proposed that the distance from the earth to the sun was between 18 and 20 times the distance between the earth and the moon. He believed that the fixed stars and the sun were immovable and that the earth was carried around the sun in a circle. It was only about 450 years later that Ptolemy, who lived from 100 to 170 A.D., suggested a geocentric theory. The earth, he believed, was a fixed sphere in the center of the universe. The sun and the moon traveled in eccentric circles around the earth. It was this theory rather than the theory of Aristarchus that was accepted until the time of Copernicus. Similarly the circumference of the earth was measured by Eratosthenes of Alexandria who lived from 276 to 195 B.C. His measurement was wrong by only some 70 miles, but his figure was later disputed by scientists who believed that the circumference of the earth was less than one-half the figure which Eratosthenes had determined. Fortunately or unfortunately Columbus accepted the figure of the scientists of his day and estimated the distance to the Indies at about 2,500 miles whereas it was actually 12,000 miles. Contrary to what is often said, advisors to Ferdinand and Isabella objected to Columbus' proposal not because they believed the earth was flat but because they were inclined to accept the figure of Eratosthenes or a figure for the circumference of the earth somewhat between his figure and that propounded by Columbus. But Columbus argued effectively and Ferdinand and Isabella agreed to support his project. If he had recognized the actual circumference of the earth he probably would not have sought to sail to India by sailing west. It was only because he had accepted a revised figure which proved to be wrong that he believed his project feasible.

Scientific discoveries can also be ignored. Mendel's work was ignored for many years, and the work of Miescher on DNA was passed over. In 1869 he studied the nucleus and discovered and isolated what we today know as DNA.

Neither science nor religion can afford to be cocky nor can they afford to defend their own turf by suppressing ideas which

do not agree with theirs. Religion errs when it seeks to impose specific supernatural ideas on the general populace; science errs when it denies observational facts which do not fit its conceptual schemes and seeks to suppress these. It is a mistake to gloss over evidence which does not support generally accepted scientific concepts. It is also a mistake to force a teacher to present conceptual schemes with which he disagrees; this violates his academic freedom. Both science and religion err when they invoke argumenta ad hominem and when they suggest guilt by association, rejecting ideas because they are propounded by someone who has suggested other ideas that have been found unacceptable.

COMMENTS ON THE PAPER BY DR. KLOTZ.

(1) [Para. 1, p. 1, Klotz] The statement that religion and science are based on "identical" presuppositions seems extreme. Simply because some presuppositions are the same does not mean that all are the same.

(2) [Para. 1, p. 1, Klotz] Science and religion do not both presume that space has only three dimensions. This may have been so until fairly recently, but the forefront of modern efforts at obtaining a unified theory of the forces of nature involves the Kaluza-Klein 11-Dimensional Supergravity theory. For a brief discussion of this new idea, see "New Physics and the New Big Bang" by Paul Davies, Sky and Telescope, 70 (5), 406-410, (Nov. 1985).

(3) [Para. 2, p. 1, Klotz] If the majority interpretation of quantum mechanics is valid, the statement that "Both science and religion assume that the existence of objects is independent of the presence of the observer" is very suspect.

(4) [Para. 3, p. 1, Klotz] Klotz's statements about the uniformity of nature seem oddly inconsistent with those of fellow creationists like Henry Morris. Morris argues that after the Flood, uniformity was the rule, but at creation and a few other times the uniformity was severely disrupted. Some laws presently at work in the universe, such as the first two laws of thermodynamics, could not have been valid at creation and before the Fall.

Dr. Klotz wants to say that science and Judeo-Christianity are alike in assuming the uniformity of "natural" laws. Traditionally, supernaturalistic catastrophism has been considered an opposing position. Dr. Klotz may wish to argue that he is not disagreeing with his fellow creationists, since he says that God "ordinarily" works through the natural laws which He established at creation. Although his use of the word "ordinarily" does seem to cover him in this case, one cannot "have one's cake and eat it too". The assumption of science is not simply "uniformity most of the time". Science denies supernatural interventions, no matter how infrequent. Even in what is legitimately called supernaturalistic catastrophism one has periods of uniformity. Either one drops the "ordinarily" and denies supernatural interventions or one keeps it and operates within a supernaturalistic, non-scientific worldview. Note that here I'm using the common understanding of "supernatural" as involving the non-observable, non-physically detectable activities of "spirit" beings whose existence and activities are known only by mystical perception through "faith". What I've been arguing here is the consistency of Dr. Klotz's position, given what appears to be his understanding of "faith" and "supernatural".

If I were arguing from my own understanding of the concepts of "faith" and "supernatural" within the Christian worldview, I would say that a more accurate model for the biblical position

would be to say that there are interventions of "spirit" beings into the physical world but this is not inconsistent with scientific presuppositions because (a) these interventions are physically detectable if they occur, and (b) the activities of human minds, even if conceived as incorporeal entities, does not make the study of the physical expressions of mind (in psychology) or the study of physical structures fashioned at the direction of "minds" (in anthropology and archeology), for example, non-scientific. Legitimate science has metaphysical entities as part of its worldview. The existence of metaphysical conceptual entities does not require the label of "religion" unless one wants to say that all science is "religion". Also note that the famous astronomer Otto Struve has often pointed out that in the search for "intelligent life in the universe", the scientist must deal with the issue of how one recognizes "intelligence" and the activities of other "minds". Are searches by astronomers for signs of alien minds extra-scientific?

One might question whether a view that asserts God's only manifestation as being in the outworking of natural laws created "at the beginning" is not non-Christian Deism. Technically one might make a distinction, as does Baptist theologian Bernard Ramm, between a God who is continually active in "upholding" natural laws (or perhaps gravity IS the Spirit of God!)--- a theistic position --- and a God who merely created a well-designed machine "in the beginning" and "let it go on its own" --- a Deistic position. One wonders though whether such a distinction is falsifiable.

Several places in these proceedings I have pressed the issue of falsifiability. Some may accuse me, therefore, of following the out-of-vogue Popperian philosophy of science. I would deny this allegation. Although falsifiability may not be the sole or even the most important criterion of demarcation between science and non-science, it is still an important consideration.

(5) [Para. 1, p. 2, Klotz] Dr. Klotz comments that "scientific language changes, but common sense, everyday language does not." It seems clear, however, that everyday language does change. Although we may use many of the same words used hundreds of years ago, what we mean by many of them has changed. Worldviews change, and as a result, the meanings of our words change. The worldview "filters down" to everyday useage. Also note that our language today has words that were non-existent a hundred years ago, such as the words coming from space and computer technology. Perhaps Dr. Klotz would insist that such words are really "scientific language" and not "common sense language". It is not clear, however, where Dr. Klotz "draws the line" between technical and everyday language.

(6) [Para. 2, p. 2, Klotz] Dr. Klotz seems to regard the "supernatural" as something which cannot, even in principle, be

detected by our sense organs or extensions thereof. I would argue that this is not the sense in which the biblical writings portray the so-called "spirit world". If my understanding is correct, one does not have to leave the realm of science to validate the "supernatural". If it were true that such things as "spirit" are physically undetectable in principle, that still would not put justification of such belief outside the realm of science. Virtual particles, for example, are in principle physically undetectable, yet they have a legitimate place in nuclear physics. They stand for a concept that helps us understand things that we can detect.

[Para. 3, p. 2, Klotz] The use of Eddington's fishnet is unwise for at least two reasons. One, because it merely suggests the possibility of undetected things, not their probability. After all, one could equally well use Eddington's fishnet to argue for the existence of leprechauns and fairies. Surely Dr. Klotz doesn't want to put such beliefs on the same level as belief in the spirit world for example. Second, its use is unnecessary because its use is based on an unsound premise.

(7) [Para. 1, p. 3, Klotz] Dr. Klotz seems to be assuming that mass-energy had to have an "origin". Perhaps one does not need to explain the existence of mass-energy any more than one has to explain the existence of God. Is the assumption that "mass-energy always was" a "supranatural assumption"? It is a presupposition that some scientists would make and it is "unprovable", yet does that make it "supranatural"?

(8) [Para. 2, p. 3, Klotz] It is naive to believe that life can spontaneously arise in a short period of time under present environmental conditions. Thus most biologists do not believe in spontaneous generation occurring in their laboratories in their lifetimes. They do, however, almost universally believe that life "spontaneously" (but as a consequence of natural laws) arose on Earth in the distant past given millions of years and different environmental conditions (reducing atmosphere perhaps). They do not appeal to supernatural agents to explain the transition from non-life to life, unless one merely means by "supernatural" any presumption that has to be made. Making assumptions is not necessarily appealing to the supernatural.

On the other hand, it is valid to say that the Miller-Urey experiments for example do not "prove" that life originated from non-living chemicals. The details of what life is and how it originated are still unknown. The experiments do make it more probable that such is the explanation of the origin of life, however. Absolute truth is apparently inaccessible to science, yet wise judgments based on what is probable in the context of available evidence do seem accessible.

(9) [Para. 1, p. 4, Klotz] Most scientists would admit that

our conclusions regarding the distant past are somewhat less reliable than conclusions that we can test directly today, since one must extrapolate time-wise a great deal the validity of present laws of nature. It is similarly true that our confidence in cosmology may be somewhat less than the confidence we have in earth physics of the modern world, since in cosmology one must assume the correctness of physical laws over vast reaches of space and time even though they are largely confirmed experimentally only for nearby space and time. Our judgments in paleontology or cosmology, however, are more than "interesting conjectures".

Spectroscopy, for example, gives us good evidence for the uniformity of physical laws out to the most distant parts of the observable universe. Although the ways one validates the conclusions of the historical sciences may be somewhat different from how one validates conclusions regarding phenomena occurring at present, the conclusions are still based on oftentimes large quantities of evidence. They are not "mere guesses" and they are surely better than mere irrational leaps and mystical insights. Why not go to the psychic archeologists for information about the unobservable past? Should we put more confidence in the "mystical visions" of a Meister Eckhart or in scientific paleontology?

I expect that many creationists would reply that we should go to a revelation from God to get information about the past, since He was there. Perhaps. What if God hasn't revealed all we want to know about the past? I would guess they would say that then we must not seek such knowledge, since God has not chosen to reveal it to us. "Isn't this the very temptation of occult sources of knowledge," they might say. Of course, he has not chosen to reveal to us how to cure cancer either. Should we shut down the medical research institutions? Is scientific research really a modern version of sorcery --- seeking after occult knowledge?

Finally, one might ask whether the modern sciences that deal with prehistory (paleontology, paleogeophysics, etc.) are no better than the rationalizations of the Greeks, given that neither depend(ed) on experiment directly? Is not modern paleogeophysics based on a much firmer observational and theoretical base than were the rationalizations of the Greeks? Are not tests made of theoretical models of the past by modern paleo-sciences? Modern paleo-scientists as a group don't just sit in their offices and philosophize about the past. Similarly Big Bang cosmology has been confirmed by observational evidence of the $3^{o}K$ microwave background radiation, it is not mere theoretical speculation.

CONFLICT, COMPARTMENTALIZATION, AND COMPLEMENTARITY: THREE MODELS FOR UNDERSTANDING THE RELATIONSHIP BETWEEN SCIENCE AND RELIGION

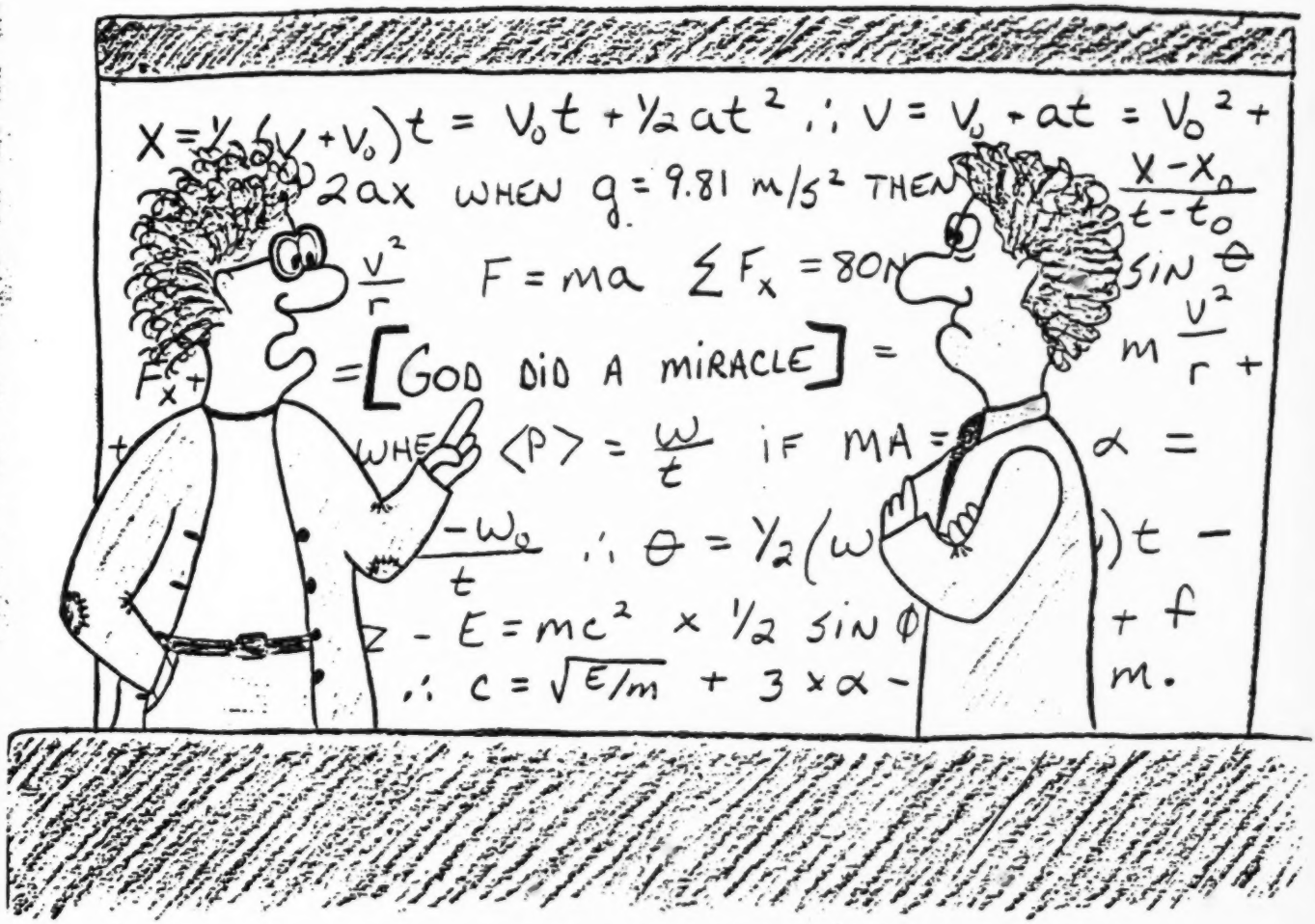
by

Mrs. Sara Joan Miles
Wheaton College

The uneasy realtionship of science and religion has been caricatured, characterized, and criticized with varying degrees of accuracy and insight. These two cartoons reflect some of the tension which exists between the two --- the first criticizing a "God of the Gaps" theology and the second alluding to the fact that there are certain limitations science encounters when it tries to test religious concepts. They reflect a culture in which theology not only is not QUEEN of the sciences, but is not even considered to be within the realm of scientific thinking. Yet while most scientists and philosophers of science consider the divorce to be final, many theologians and layman do not. They insist on maintaining the relationship. A few talk as though there has been a divorce, but act as though both science and religion are living in the same household, with strife the dominant characteristic. Others, desiring to maintain the marriage, at least in name, have settled for a "legal separation" in order to avoid discord. A third group is intent on reconciliation, a reconciliation based on mutual respect and an understanding of the nature of each member. Obviously there are some individuals and groups which espouse a form of intellectual celibacy, a commitment to an intellectual lifestyle in which ONLY science or ONLY religious knowledge is acknowledged. The Flat Earth Society represents the latter, while, I would suggest, scientists who deny even the possibility of supernatural reality hold to the former belief. The subject of this conference, however, precludes our looking at these two groups, for we are interested in the relationship, specifically, the way in which religion relates to science. I would hope, however, that in order to complete our understanding of the relationship, we might at a later date have another conference, one entitled "The Use and Abuse of Religion in Defense of Science."

What I would like to do today is to use three models --- the CONFLICT model, the COMPARTMENTALIZATION model, and the COMPLEMENTARITY model --- to describe the relationship between religion and science. Moreover, I want to use these models while placing current practitioners within an historical context. So let's begin by looking at the conflict model. Here the divorce has been granted, but strife continues over property rights. The property in dispute is nature, knowledge, and truth. Religious groups or individuals which fit this paradigm agree with the oft-cited position of Tertullian in his denunciation of philosophy:

> What indeed has Athens to do with Jerusalem? What


X = ½(V + V₀)t = V₀t + ½at² ∴ V = V₀ + at = V₀² +
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∴ c = √E/m + 3 x α -
X - X₀
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SIN θ
m v²/r +
α =
)t -
+ f
m.

"I THINK YOU NEED TO BE A LITTLE MORE SPECIFIC IN THIS STEP!"

FIGURE 1

"It may very well bring about immortality,
but it will take forever to test it."

FIGURE 2

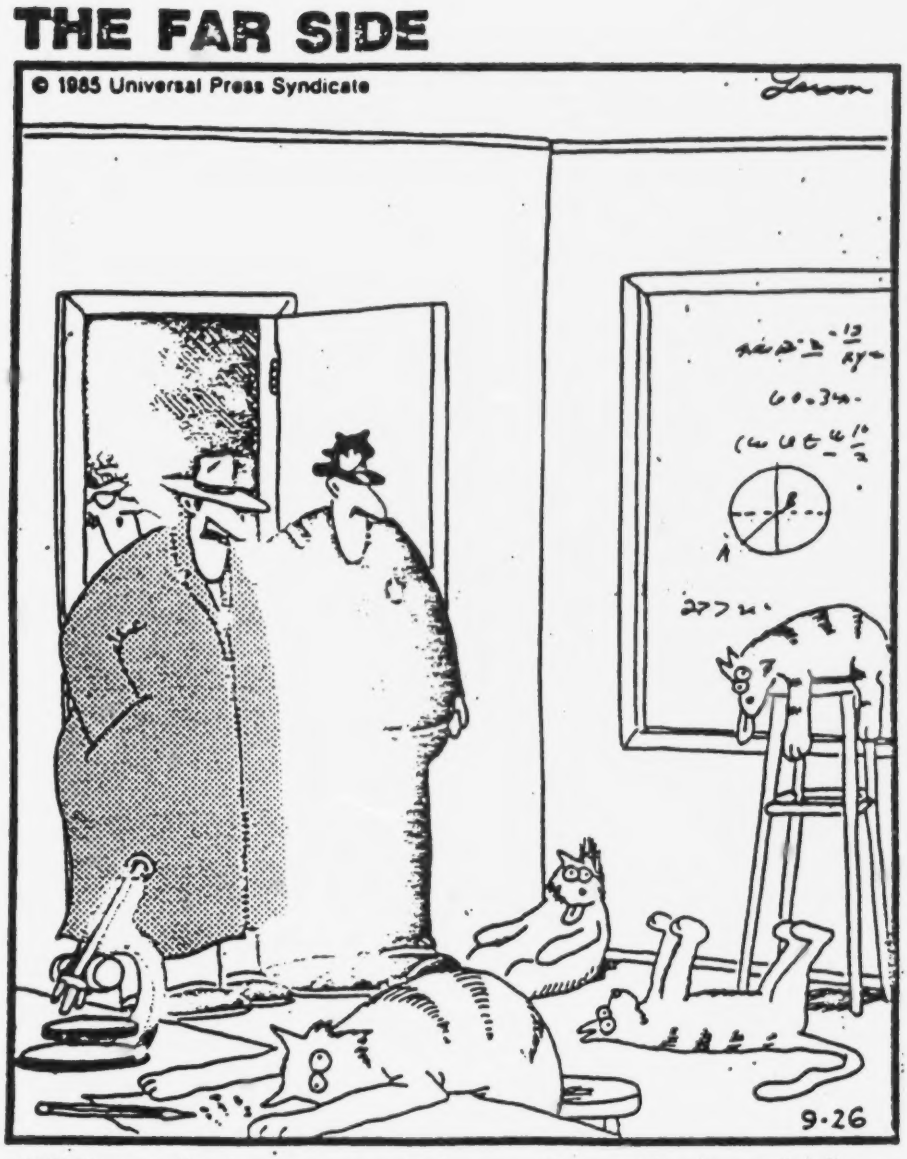
> concord is there between the Academy and the Church? What between heretics and Christians? Our instruction comes from "the porch of Solomon," who had himself taught that "the Lord should be sought in simplicity of heart." Away with all attempts to produce a mottled Christianity of Stoic, Platonic, and dialectic composition! We want no curious disputation after possessing Christ Jesus, no inquisition after enjoying the gospel! With our faith, we desire no further belief. For once we believe this, there is nothing else we ought to believe.

We also find Tertullian rejecting the intellectual spirit which is at the basis of the Scientific enterprise --- a fundamental curiosity about nature --- when he wrote:

> Now, pray tell me, what wisdom is there in this hankering after conjectural speculations? What proof is afforded to us, notwithstanding the strong confidence of its assertions, but the useless affectation of a scrupulous curiosity, which is tricked out with an artful show of language? It therefore served Thales of Miletus quite right, when, star-gazing as he walked with all the eyes he had, he had the mortification of falling into a well .... His fall, therefore, is a figurative picture of the philosophers: of those, I mean, who persist in applying these studies to vain purpose, since they indulge a stupid curiosity of natural objects, which they ought rather intelligently to direct to their Creator and Governor. (1)

According to Hans Blumberg, Augustine followed this same anti-curiosity, anti-investigative approach, and so Blumberg concludes that "the campaign against curiosity is the main sin for which Christianity has to stand." (2) Both Tertullian and Augustine might have used this cartoon to summarize their views.

Now I would like to draw your attention to several things. First, this position should LOGICALLY characterize groups which totally reject science and its claims, and I'm not sure that any such groups exist, unless perhaps it is the Flat Earth Society. Secondly, I reject Blumberg's reading of the relationship of the Church and science in the Middle Ages as one in which the former curtailed the activities of the latter. Such a position totally ignores the vast scholarship of the last twenty years which demonstrates, I think conclusively, that the Middle Ages was not a period of intellectual stagnation which deserves the epithet "Dark Ages." In fact, it is the marriage which took place between science and religion during this time, and especially the Thomistic synthesis of the 13th century, which has created theoretical, methodological, and technological offspring which virtually prohibit anyone from living conceptually or existentially in a first century world. This means that if one were to continue today to insist that ALL knowledge is received



"Notice all the computations, theoretical scribblings and lab equipment, Norm. Yes, curiosity killed these cats."

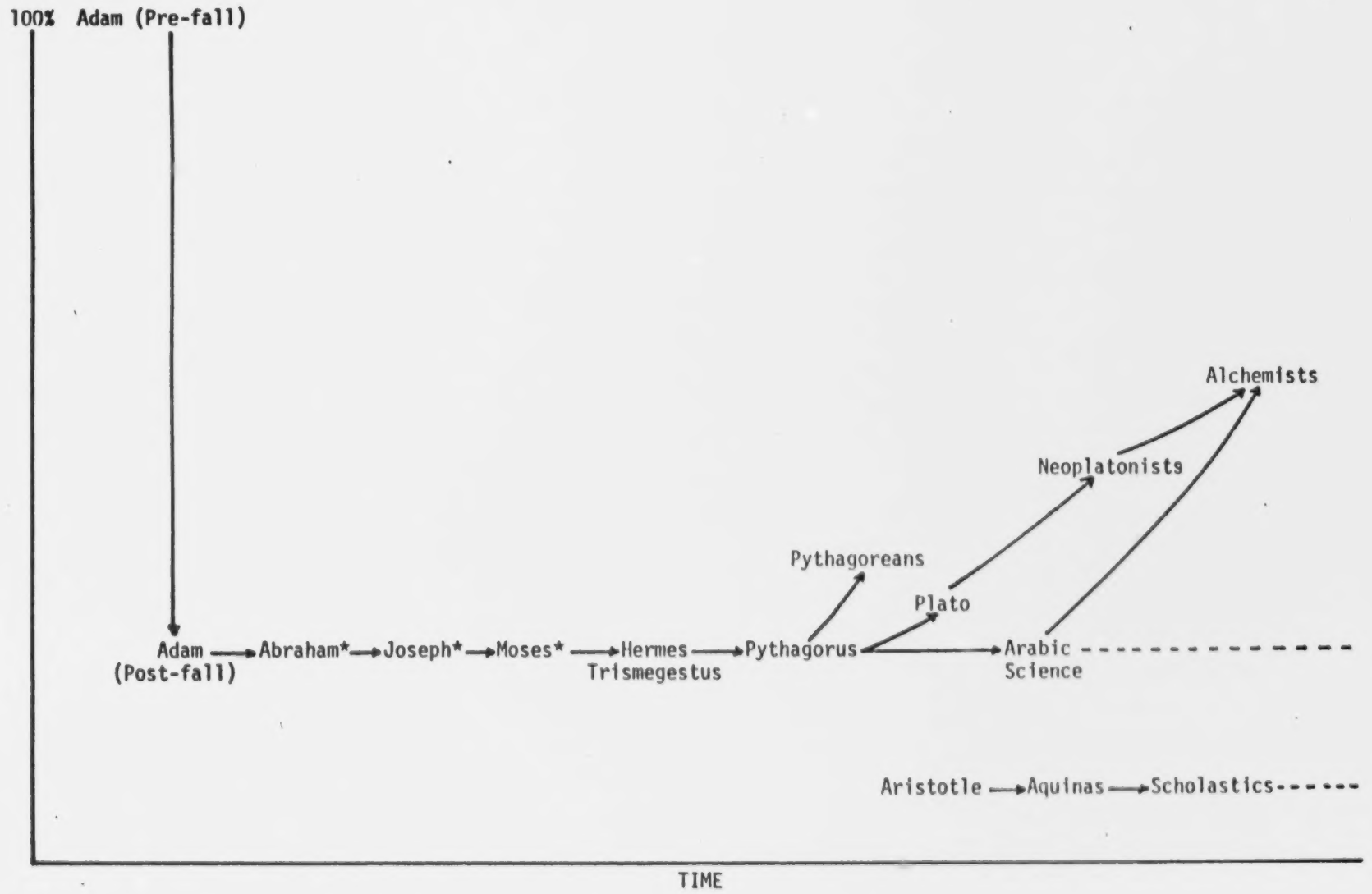
FIGURE 3

by revelation (or from "Solomon's porch," to use Tertullian's words), he would find himself in a dilemma with respect to science, for to accept the benefits of science --- the medical and technological advances --- while rejecting the theoretical structures or the conclusions derived from theory and method raises questions, it seems to me, of intellectual honesty.

The fact is, however, that while for religious proponents of the position we're describing ALL knowledge is revealed, it is not necessarily RECEIVED by revelation. An examination of the Hermetic tradition provides us, I think, with our historical counterpart to modern-day Creation Scientists. For those of you who aren't familiar with the 16th and 17th century alchemical strain of the Scientific Revolution, I'll review a bit of the history. These scientists believed that Adam had possessed all knowledge, but that, as a result of the Fall he had lost part of it. Increasing sin, as reflected in the first chapters of Genesis and leading up to the Flood, caused more and more of that knowledge to be lost to man. Finally, what knowledge was left was sealed by Hermes Trismegistus (and no, that fact is not found in Scripture), who, according to legend, lived in Egypt shortly after the time of Moses. Later, it was taught, both Pythagoras and Plato studied in Egypt and learned some of the original knowledge. But more than learning the knowledge, they learned HOW to recapture the lost revelation. Aristotle, however, effectively squelched the Platonic approach, and substituted an atheistic, speculative methodology based on deduction. The Church, unfortunately, had chosen to follow Aristotle instead of Plato, and therefore could not learn to read and understand what God had hidden in nature. For the alchemists, revelation was the source of knowledge, but it was not the WAY to knowledge, and the Paracelsians and alchemists insisted on returning to Nature, in a sense, on manipulating Nature, to wrest from Her the secrets hidden almost "from the foundation of the world."

The conflict between these scientists and the "official" scientific community was not over the nature of knowledge; it was a methodological conflict. Alan Debus states the problem in this way:

> Aristotelian thought was based on logic, but logic is useless for the growth of knowledge since it explains its own statements only and never adds anything new. In reality, knowledge may be acquired by divine grace alone; either by some direct mystical experience or by direct experimentation in nature. As Pagel has summarized the argument,
>
> > by means of unprejudiced experiment inspired by divine revelation, the adept may attain his end. Thus, knowledge is a divine favour, science and research divine service, the connecting link with divinity.



*Lived in Egypt

FIGURE 4

> Grace from above meets human aspiration for knowledge from below. Natural research is the search for God. (3)

The scientific community did not take kindly to the criticism of its work, nor was it willing to incorporate the religious-philosophical-mystical presuppositions of the alchemical adepts. Since, as a group, these men placed themselves in a religious tradition which opposed the established church, at least in the early period, their work was viewed in part as an attack by religious heretics on science. What is important to see, however, is that while there were indeed religious and philosophical aspects to the conflict, the MAJOR issue was over how science should be conducted --- it was a methodological conflict WITHIN science.

George Marsden, in his article "Understanding Fundamentalist Views of Science" makes the same point with respect to the religious right. He argues that fundamentalists, from the turn of the century on, were far from being antiscientific. Rather, when fundamentalism is examined as a belief system, it turns out that it reflects what Marsden calls "a striking commitment to the assumptions and procedures of the first scientific revolution." He goes on to say that

> Fundamentalist thinkers are in a broad sense Baconians --- followers of roughly the principles for attaining objective certainty enunciated by the early seventeenth-century philosopher of science Francis Bacon. True science in this view is a matter of induction. It involves careful observation and experimentation to discover the facts, and generalize from them. While some judiciously conceived hypotheses might be entertained to guide generalization and experimentation, speculative hypotheses incapable of verification by observation are beyond the realm of true science.

This is precisely the form of argumentation which Henry Morris uses. Relying on a rather superficial understanding of Popper's falsification principle and a Baconian definition of science, Morris can say:

> Science is <u>knowledge</u> and the essence of the scientific method is experimentation and observation. Since it is impossible to make observations or experiments on the origin of the universe ... the very definition of science ought to preclude use of the term when talking about evolution. (4)

Just as the alchemists held certain presuppositions about the <u>fact</u> of revealed knowledge, and hence the assurance that it could with certainty be discovered and confirmed, so the American fundamentalists believe that science, properly done, will <u>confirm</u>

the revelation of Scripture. Aristotelian deduction and Darwinian speculation conflict because each is "bad" science, at least according to the definition held by those opposing the scientific establishment.

This helps us understand one point which has often been taken as an internal contradiction within Creation Science --- the acceptance of biological explanations of embryological development while rejecting evolutionary explanations. What is the criterion for determining if one agrees with the scientific conclusions or not? It can not just be a matter of harmonization with Scripture, for there are numerous Biblical references to God's involvement in embryological process. Psalm 139:13 states: "For thou didst form my inward parts, thou didst knit me together in my mother's womb." Isaiah 44:24 even connects the God who makes the individual with the God who created the universe: "Thus says the Lord, your Redeemer, who formed you from the womb: 'I am the Lord, who made all things, who stretched out the heavens alone, who spread out the earth' ...." Yet with all of this Biblical evidence, I have never heard a Creation Scientist argue for a literal interpretation of these verses or for a rejection of embryological explanations. Why not? Because the science upon which these explanations are based is "good" science, science based on observations and experimentation. The inconsistency, therefore, does not deal with the supposed selective acceptance or rejection of scientific pronouncements, but rather in the area of Biblical exegesis and hermeneutics. Science is used as an external principle for interpreting revelation: so-called "good" science may require a figurative or poetic reading of a passage, whereas science which is defined as "bad" permits any reading which is desired --- literal, allegorical, or poetic.

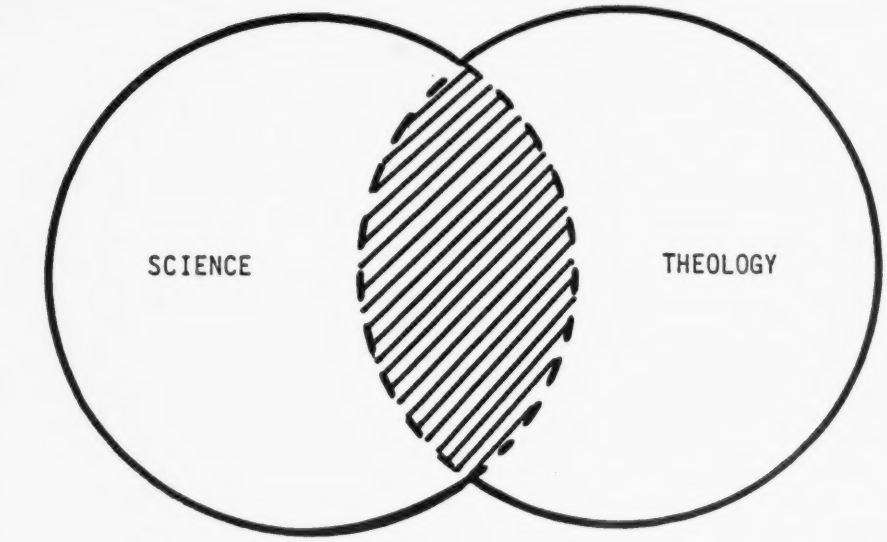
At the same time that we see exegetical inconsistencies, we can also discover a methodological contradiction. A very informative article appeared in the March, 1985, issue of The Quarterly Review of Biology entitled "The Elusive Scientific Basis of Creation 'Science.' " The authors of the article, Eugenie C. Scott and Henry P. Cole, raise the question "Is there, as claimed, scientific support for 'scientific creationism'?" The fact that Morris believes that evolutionary science is non-scientific does not mean that the type of science which he advocates is disdained by the scientific community. This means that evidence derived in the Baconian, inductive manner which could support the creationist model would be the proper scientific way of refuting the evolutionary model. If, therefore, Creation Science is indeed a science, and science is by definition experimentation and observation, then what is the scientific evidence? The answer, according to Scott and Cole, is that there is none. Out of over 135,000 journal submissions from 1980 to 1983, only 18 dealt with empirical, experimental, or theoretical support for scientific creationism, and 12 of these

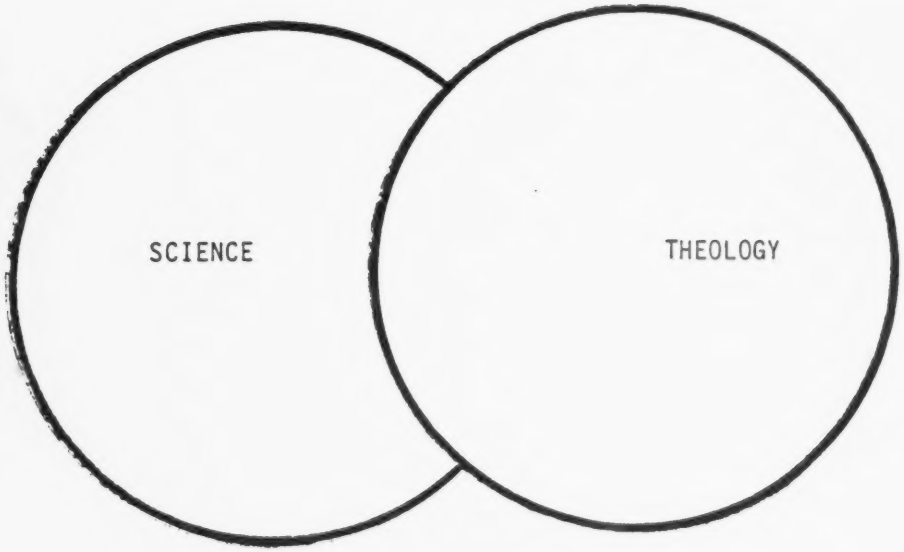
were submitted to one science education journal. (5) Moreover, within the review process, it was felt that these articles were written by laymen rather than by professional scientists. But the important issue is that what is being written as science does not meet their own definition of "good science." For example, imposed on the "observation and experimentation" definition is the logical principle that only two conclusions are possible: evolution OR creation. Most of the "scientific evidence" is of this kind. For example, the second law of thermodynamics prohibits evolution, thus creation must have occurred, or the Po halos in granite, coalified wood, mica, and other substances are anomalies incompatible with evolution, and hence special creation must have taken place. Rather than basing their position on a kind of science which does not even meet their own criteria for good science, scientific creationists should seek to be internally consistent --- to construct testable questions and let the evidence speak for itself. As it is, they not only place themselves in opposition to the scientific community as a whole, their practice of science places them in opposition to their own ideals.

Let's look now at the second model. I have characterized the compartmentalization model as a legal separation. It might also be described as a kind of intellectual schizophrenia. Usually it is not as naive or calculated --- I'm not sure which --- as the case I ran across as an undergraduate at Ball State. I was told of a friend's decision NOT to continue graduate studies in comparative anatomy, but rather to switch to genetics since, he informed me, comparative anatomy might undermine his faith. He fits into the group which compartmentalizes reigion and science in the following way: both science and religion are viewed as appropriate avenues to arrive at truth, but if there are conflicting conclusions, the conflict is ignored --- not resolved, but just ignored.

As you are probably aware, historically the common way of describing the relationship between science and religion, between reason and revelation, was to refer to the two books: The Book of Nature and the Book of Scripture. Both were valid and necessary books, and the understanding which derived from both should correspond. But what if it did not? The early response was to submit reason to the authority of revelation, to faith, to doctrine. The classic case, of course, is the submission of Galileo to the Pope and the Church in 1633. We can probably identify with this statement written by Galileo in a letter to the Grand Duchess Christina:

> ... I think that in discussions of physical problems we ought to begin not from the authority of scriptural passages, but from sense-experiences and necessary demonstrations; for the holy Bible and the phenomena of nature proceed alike from the divine Word, the former as the





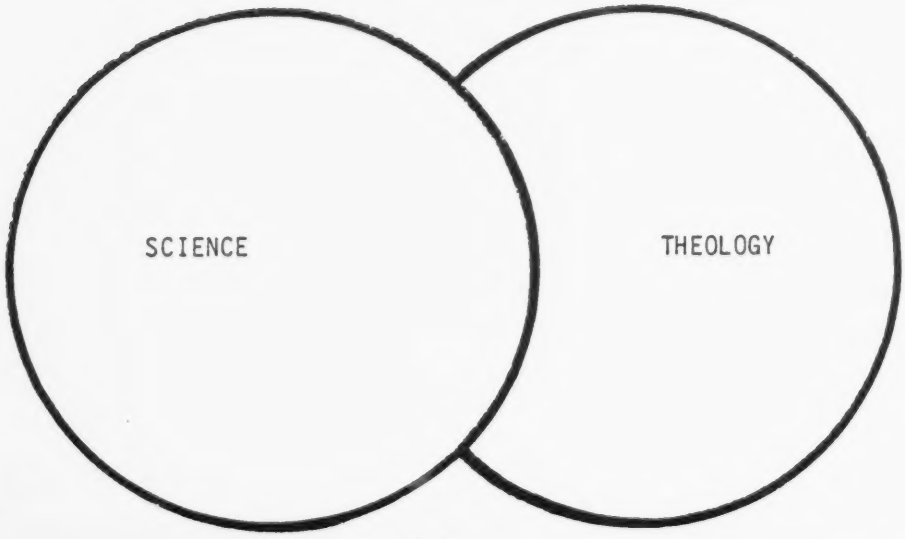


FIGURE 5

> dictate of the Holy Ghost and the latter as the observant executrix of God's commands. It is necessary for the Bible, in order to be accomodated to the understanding of every man, to speak many things which appear to differ from the absolute truth so far as the bare meaning of the words is concerned. But Nature, on the other hand, is inexorable and immutable; she never trangresses the laws imposed upon her, or cares a whit whether her abstruse reasons and methods of operation are understandable to men. For that reason it appears that nothing physical which sense-experience sets before our eyes, or which necessary demonstrations prove to us, ought to be called in question (much less condemned) upon the testimony of biblical passages which may have some different meaning beneath their words. For the Bible is not chained in every expression to conditions as strict as those which govern all physical effects; nor is God any less excellently revealed in Nature's actions than in the sacred statements of the Bible. (6)

Now this appears, at first glance, to be an example of conflict -- or possibly some kind of accomodation on the part of Galileo, who will seek alternative ways to interpret the Book of Scripture. But I maintain that it really is a case of compartmentalization. Galileo was essentially a rationalist, and he believed that a more adequate and significant knowledge of God's creation could be found in the Book of Nature than in the Book of Scripture. This quotation makes that point abundantly clear. But he was also a commited Christian, who did not question the authority of the Pope and the Church, not even when that authority contradicted him when he sought to interpret the Book of Nature. Just prior to this statement, he had written:

> Therefore I declare (and my sincerity will make itself manifest) not only that I mean to submit myself freely and renounce any errors into which I may fall in this discourse through ignorance of matters pertaining to religion, but that I do not desire in these matters to engage in disputes with anyone, even on points that are disputable. My goal is this alone: that if, among errors that may abound in these considerations of a subject remote from my profession, there is anything that may be serviceable to the holy Church in making a decision concerning the Copernican system, it may be taken and utilized as seems best to the superiors. And if not, let my book be torn and burnt, as I neither intend nor pretend to gain from it any fruit that is not pious and Catholic. And though many of the things I shall reprove have been heard by my own ears, I shall freely grant to those who have spoken them that they never said them, if that is what they wish, and I shall confess myself to have been mistaken. (7)

How could he say this while declaring the superiority of the Book

of Nature for learning about "physical problems?" Only by affirming the authority of the Pope and the Church. In effect, what he was saying is this: "The science I practice leads me to Truth; my Church tells me what is True; my Church forbids me to believe the Truth my science teaches me; blessed be the Truth!"

Later, in the 18th century, when Newtonian physics and Cartesian philosophy limited God to the beginning and end of time and to the periphery of space, scientists and churchmen could operate in a mechanistic and necessarily determined universe while affirming miracles, free-will, and a God who was personally present in the sacraments and in the life of the believer. Moreover, they did this without seeing --- or at least without seeking to reconcile --- the inherent contradiction. In the 19th century James Clerk Maxwell, the Scottish physicist, demonstrated clearly this position. He was one of the foremost scientists of his day, and he was also described as a deeply commited Christian who read his Bible and prayed daily. But, he absolutely refused to relate his science and his theology, surprisingly to us because he held his science so tenuously.

> There was risk, he said, that if some result of science was used to support or illustrate a theological doctrine, the two would become wedded together in the popular mind. When the science was "dated," then it would seem to all men that religion itself was old-fashioned --- married to out-of-date science. This was the reason he gave for declining to join the Victoria Institute which existed (and still exists) to discuss the relations between the Christian faith and current knowledge. (8)

Are there such compartmentalists today? Yes, but I would maintain that the separation takes a different form. I have no hard data on which to make the following assertions, only impressions garnered through teaching in a religious college for 10 years, discussions with colleagues, and membership in an organization of Christian scientists. My thesis is that one would find a disproportionately high number of "applied" scientists coming from the ranks of the "religious right" and a correspondingly low number of theoreticians. Today, a student from a typical evangelical or fundamentalist church might be encouraged to enter medicine or engineering, one who likes psychology could become a clinical psychologist, and economics could draw one to business, but not molecular genetics, behavioral psychology, or economic theory. The American Scientific Affiliation, which is oriented toward the academic or theoretical scientist who affirms a conservative doctrinal position, has a relatively small number of members, while the Christian Medical Society is much larger. The Creation Research Society is known for having a large number of engineers. Involvement in the applied sciences allows one to utilize the benefits produced by science, and even to fulfill a service-

oriented or mission mandate, but it also allows one to evade the more theoretical and philosophical issues which are most likely to be at variance with one's theology. One might say that, as a group, religious conservatives tend to abuse science by eating its fruits while treating it as a weed.

Now, both the conflict model and the compartmentalization model share a common presupposition; namely, that theology and science ask the same kinds of questions about the same kind of reality. In the former case, conflict arises when the answers each discipline gives cannot be harmonized; in the latter case, isolation of the disciplines occurs under these circumstances. In both cases there is not a clear demarcation of the subject matter or the domain. Whether one gives priority to religious faith or to science (dare I say "scientific faith?"), these two models assume that the heirarchy of methodology and of knowledge, both from the point of view of content and source, involves, to use a mathematical model, elements of the same set. A theological fact and a scientific fact carry equal weight, for each is a fact and they are facts about the same thing --- Nature. This is why we see what I have called on the abstract "conceptual and methodological confusion" among members belonging to these models. Let me just give an example before moving on to the last paradigm. Among creation scientists, one of the primary points of attack is the acceptance by the scientific community of the principle of uniformitarianism. For these creationists, the theological "facts" of at least one catastrophe (the flood) and of two occasions when the sun did not continue in uniform motion provide the basis for rejecting the uniformitarian doctrine. Yet, the methodological practice of extrapolation depends upon a uniformitarian view. Scott and Cole, in the article I mentioned earlier, stated

> Creationist scientists regularly extrapolate from mainline scientific publications to conclusions which support their perspective. All scientists extrapolate to some degree from observation to conclusions, but creationist extrapolations regularly border on the extreme. Many "proofs" of special creation involve extrapolations of rates of change, often taken from evolutionary sources. Thus one source gives a rate of deposition of meteoritic dust on the moon ...; if one extrapolates from this rate, and if one assumes that the moon and earth are billions of years old, the moon should be covered with hundreds of feet of dust, not just a few inches .... If one extrapolates the rate of erosion of land masses from the current rate, then all the continents would be washed away if the world were billions of years old .... (9)

Now note the situation: scientific "facts" like the rate of erosion can be used to prove the theological fact of special creation only by utilizing a scientific principle which is

disproved by other theological facts. That, for me, reflects confusion! It indicates, on the one hand, confusion over the use of scientific facts and theological facts, and it demonstrates, on the other, the lack of criteria for evaluating evidence or presuppositions.

Then, can we be any happier with the complementarity model, with the group who is seeking to bring about a reconciliation? Well, there certainly are problems, even here. Both sides are leery of the other --- afraid that the other will try to exert "undue influence" in the relationship. Both are defensive --- desiring that the other accept both the good and the bad; trusting that, in time, the false will be shown to be false and rejected, while the truth will finally come to light. Both are certain that the other will lay down conditions which will compromise integrity and identity. Both are afraid that a relationship could quickly slip into conflict or slowly decline into irrelevancy. Both know that it will take enormous effort and will result in much misunderstanding from the two sets of "families." Finally, there are some past attempts which seem to be miserable failures --- or, at least abortive trials. No one wants today to return to anything like the Thomistic synthesis. But, the dominant views up through the early half of the 17th century, while differing in content, were identical in form to that of Aquinas. The relationship was one of unity. If you remember the old stereoscopic viewers, you will have the model. The card has two pictures; we put the card in the viewer and suddenly were able to see one 3-dimensional scene. The stereoscope unified the pictures so that we could see more than what either picture, by itself, revealed to us. So, with the early Middle Ages and early Renaissance view. Natural philosophy (the science of its day) and theology were juxtaposed so that both God and nature were known more fully. Would you like to hear some Middle Ages Biology?

> There is an animal called the elephant whose copulating is free from wicked desire .... If the elephant wishes to produce young, he goes off to the east near paradise where there is a tree called the mandrake. And he goes there with his mate, who first takes a part of the tree and gives it to her husband and cajoles him until he eats it. After the male has eaten, [they join together] and the female immediately conceives in her womb. And when the time comes for her to give birth, she goes to a pond and where the water reaches her dugs (that is, the female's) she brings forth her offspring (that is, her young). Since the calf is born in the water, it swims about and finds the thighs of its mother and is suckled at her teats. The male elephant guards her while she gives birth because of the serpent who is an enemy to the elephant. [If the female gave birth outside the water, the serpent would steal her calf and devour it. Therefore, she goes into deep water and gives

birth there. The male does not leave her but rather guards her while she gives birth because of the serpent who is an enemy to the elephants.] If the elephant finds a serpent, he kills it by trampling on it until it dies.

This is the nature of the elephant: if he should fall, he is unable to get up again. But how can he fall since he rests against a tree? The elephant has no knee joints enabling him to sleep lying down if he wanted to. Shortly before the beast arrives at the tree against which he is accustomed to rest, the hunter who wishes to capture the animal cuts partly through the tree. When the elephant comes and rests against the tree, both tree and beast fall at the same time. The elephant then cries out and immediately there comes a great elephant who is unable to lift the first. Then they both cry out, and twelve other elephants arrive, and not even they can lift the one who has fallen. Then again, they all cry out, and suddenly a tiny elephant appears who puts his trunk under the great one and lifts him up. It is one of the natural qualities of the tiny elephant that, where any part of his hair or bones is burned, neither the dragon nor any other evil thing may come. [Thus, whoever has the works and commands of God within himself purifies his heart, and no thought of the devil can enter. And whatever harmful wickedness was there will immediately vanish leaving no harmful spirit, hostile thought, or misdeed of the devil.]

The great elephant and his wife represent the persons of Adam and Eve. While in a state of virtue (that is, while they pleased the Lord), before their transgression, they had no knowledge of copulation, nor any awareness of the mingling of their flesh. When, however, the woman ate of the tree (that is, the intelligible mandrake) and gave to her husband, she became big with evil; because of this act they were expelled from paradise. Yet as long as they were in paradise Adam had no knowledge of Eve. This is clear since thus it is written, "And after Adam and Eve were expelled from paradise, then Adam knew his wife, and she conceived and brought forth Cain" [Gen. 4:1] over the blameworthy waters. And David said, "Save me, for I have entered the water up to my soul" [Ps. 69:1]. Immediately, the dragon overthrows them and makes them strangers to virtue (that is, by not pleasing God). And they cry out, calling on God and a great elephant comes (that is, the Law) and does not lift them. Indeed, even as the priest did not lift up the one fallen among thieves [cf. Lk. 10:30]. Nor did the twelve elephants (that is, the chorus of prophets) raise him up, even as the Levite failed to raise up the one wounded by thieves [cf. Lk. 10:32]. But the holy intelligible elephant (that is, the Lord Jesus Christ) did so. Although he is greater than all the rest, he was made

> small in comparison to them. "For he humbled himself and became obedient unto death" [Phil. 2:8], in order to raise up man. He is the intelligible Samaritan who raises us up onto his breast (that is, the body). "For he himself has borne our infirmities and carried our weaknesses" [Is. 53:4]. In Hebrew Samaritan means guardian and David said of him in Psalm 114, "The lord is guardian over the little ones" [Ps. 113:7]. Where my Lord is present, neither the dragon nor any other evils can approach. Physiologus spoke wisely, therefore, of the elephant. (10)

I'm sure you all learned some things about elephants you never knew before! We can laugh now at both the science and the theology, but it is essential to notice that the level of science did not differ that much --- either in content or methodology --- from Pliny, and the theology was consistent with both the tripartite method of Origen and the four levels of the Quadriga. Moreover, both disciplines were comfortable with the use Physiologus made of biology, namely, biology as illustration of scripture. The use of the "Two Books" model through the 17th century, while producing both scientific theories and theological systems which we would reject today --- both because of the methods used and the conclusions drawn --- was perfectly acceptable at that time to both the scientific community and to the theologians. The 18th and 19th centuries did not seek a unified vision from their scientific and theological studies, but rather saw the two realms as complementary, with natural theology forming the bridge between the natural order and revealed religion.

Each domain carried on its activities within its own community of scholars, accepting the philosophical presuppositions, the methodologies, and criteria concerning evidence and reasoning of the respective disciplines. There was a concomitant development occurring which affected the changing world-view of the period. Attempts to bridge the disciplines or to bring about the resolution of conflicting interpretations were based on the recognition that science must be science and religion must be religion. The more or less concurrent revolutions of Darwinian science and higher criticism fractured both domains --- and so science no longer knew what good theology was, and theology was confused about science. Science has since managed to restore a sense of unity and identity, but there is not yet the same degree of unity in theology.

Nevertheless, the principle is established: neither discipline can follow a reductionistic <u>modus operandi</u> when dealing with the other. By that I mean that the particular questions and methods of one field must be respected by the other rather than reduced to agree with one's own. Current abuse of science by religious groups most often occurs when this principle is ignored.

The complementarity model, however, must have more than one principle to guide its agenda, and it is a lack of a clearly articulated and agreed upon research program which leaves the vacuum for practitioners of the conflict or compartmentalization models to fill. I think suggestions such as these proposed by Howard Van Till are a good place to start. In an article in the September, 1985, Journal of the American Scientific Affiliation entitled "Categorical Complementarity and the Creationomic Perspective" he builds on the work of Donald MacKay. He proposes that science and theology see the world from different viewpoints, views he calls " 'categorically complementary' because they differ in the categories of questions which they address." (11) He defines the questions as "internal affairs;" which is the domain of science and "external relationships," the subject of theology. The steps in his methodology are to

(1) Categorize all of our questions concerning the material world under two headings: external relationships and internal affairs.

(2) Direct all external relationship questions to the Bible, and seek answers by faithfully and diligently applying the rules for biblical exegesis.

(3) Direct all internal affairs questions to the Creation, and search for answers by honestly and carefully applying the methods of natural science.

(4) Recognize the views of the cosmos seen through the spectacles of biblical exegesis and through the spectroscopes of natural science as being complementary, and integrate them to form a unified and comprehensive perspective.

Such an approach makes some assumptions which relate to both science and theology. First it affirms the reality of both Nature and the Supernatural. Secondly, it affirms that the methodologies of each domain, when properly executed and continually critiqued and modified by the professional communities which use them, will bring us closer to a "truthful" understanding of the respective objects of study. Thirdly, it holds tenuously the results of its research. It adopts something of an instrumentalist approach in science --- not affirming that TRUTH or NATURE is relative, but that our UNDERSTANDING is. And it approaches theological science the same way, asserting that GOD IS and that HE IS TRUTH, but is unwilling to affirm those claims about our present state of understanding. Finally, it is willing to live with ambiguity. It is able to admit its inability to find reconciliation through ignorance or error within one or the other fields or simply through the lack of creative reconciliation --- but it does not give up the hope that reconciliation will be achieved.

Treatment of Question Categories

Categories of Questions about the Material World	*Appropriate Sources of Answers for the Christian*
INTERNAL AFFAIRS	
1. Properties 2. Behavior 3. History	The created cosmos itself, which is constituted and governed in such a way that is amenable to empirical investigation and is intelligible to the human mind.
EXTERNAL RELATIONSHIPS	
1. Status 2. Origin 3. Governance 4. Value 5. Purpose	The Bible, the covenantal canon, which was written principally for the purposes of revealing the divinely established convenantal relationship among God, mankind, and the rest of Creation, and of providing a witness of past human experience with the Creator-Redeemer.

Yet it also makes another affirmation, namely, that the understanding of reality provided by either discipline is, by its very nature, incomplete and therefore inadequate for building a total world-view. To adopt scientific findings to answer those questions or to complete those understandings which lie outside the domain of theology is the appropriate use of science by religion. For science to turn to theology in the parallel situation is also the appropriate response. And that recognition means each can use insights, data, conclusions, and concepts to extend its own understanding, in other words, to confirm and to clarify understanding, or to create new areas of research, but this is not the same as using science to defend religion. In this model, neither side requires defense, for neither is under attack from without, only correction and extension from within. To use either science or religion any other way is abuse, and hurts the abuser more than the abused.

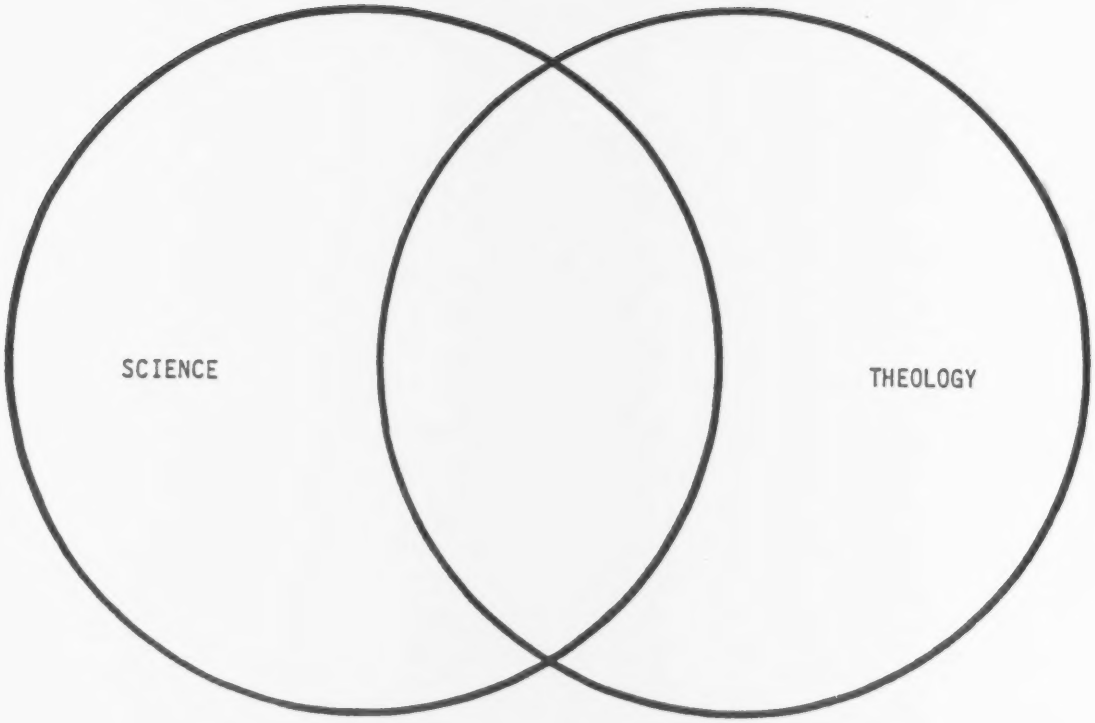


FIGURE 7

1. Cited by David C. Lindberg, "Science and the Early Christian Church," Isis, 74 (274):515-516, 1983.

2. See Owen Gingerich, ed. The Nature of Scientific Discovery: A Symposium Commemorating the 500th Anniversary of the Birth of Nicolaus Copernicus. Washington, D.C.: Smithsonian Institution Press, 1975. pp. 515-516.

3. Allen G. Debus. The English Paracelsians. New York: Franklin Watts, Inc., 1965. p. 21.

4. George M. Marsden. "Understanding Fundamentalist Views of Science" in Science and Creationism, edited by Ashley Montague. Oxford: Oxford University Press, 1984, pp. 97-98.

5. Eugenie C. Scott and Henry P. Cole. "The Elusive Scientific Basis of Creation 'Science,' " The Quarterly Review of Biology, 60(1):21-30, 1985.

6. Galileo. Discoveries and Opinions of Galileo. Translator. Stillman Drake, Garden City, New York: Doubleday Anchor Books, 1957. p. 182.

7. Galileo, pp. 180-181.

8. Robert E. D. Clark. The Christian Stake in Science. Chicago: Moody Press, 1967. p. 11.

9. Scott & Cole, pp. 26-27.

10. Physiologus, Translator Michael J. Curley, Austin, Texas: University of Texas Press, 1979, pp. 29-32.

11. Howard Van Till. "Categorical Complementarity and the Creationomic Perspective." Journal of the American Scientific Affiliation. 37(3):151, 1985.

12. Van Till, p. 155.

SCIENCE IN DEFENSE OF WHOSE GOD?

by

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I am both honored and surprised to be here reading a paper at this conference. I am honored because it is always an honor to be listened to by one's colleagues in academe. It is always an honor when students listen to a teacher, but it is especially so on a Saturday. And it is an honor to be on the same program with a man who was once, in a way, one of my teachers. Dr. Klotz was on the faculty of the college from which I earned my B.A., though because of my major I did not have a class with him. There is some trepidation which comes with saying things in public in the presence of one's teacher, but there is also a kind of security. If you do not like what I say, I will pass the buck and plead that Dr. Klotz is somehow responsible for the kind of person I turned out to be.

I am surprised to be here because in some ways I am a fish out of water at a conference such as this. Were you to check my union card it would say that I am certified only to speak about the exegesis of the Hebrew and Christian scriptures. It is only fair to tell you, too, that I carry the credentials of another guild. I am an ordained Lutheran minister, and in addition to teaching I serve on the pastoral staff at Valparaiso University. Thus, some of what I say comes out of a pastoral concern for the wholeness and faith of the young people whom I serve as well as teach.

I need not have told you that I am a Lutheran, no doubt. The abstract of my paper, which I presume most of you have in your possession by this time, makes it quite clear that I am a Lutheran. It is written in the form of a series of theses. At least though, I kept the number to ten and did not nail them to the door of this meeting room. We have come a little ways, it seems, in the last 450 years. I will proceed to attempt an explanation and defense of each of those theses.

Thesis 1 - The universality of religion and religious beliefs suggests that religious systems flourish with or without science providing defense for religious beliefs.

It is a simple fact that human beings are by nature religious, and for as long as there have been human beings, there have been religions, that is, symbol systems by which people answer the fundamental questions concerning human identity, value, purpose, and meaning. I have learned from the late Ernest Becker (Denial of Death and Escape from Evil) that being

religious is a part of what makes beings human beings, because human beings, unlike other beings, are excruciatingly aware of their mortality, finitude, and fundamental expendability. For only a brief time each one of us knows human life, and then each of us must die. The world will go on as though we had never existed. Like the grasshopper or the chicken, the human becomes food for worms. But the human being must live while knowing that such a fate is coming and having the capacity to reflect upon it. What will it mean to have been me among the millions and billions?

Religions of all kinds answer that basic question, and everybody has a religion, i.e., a way of oragnizing life around some center, core, or complex of symbols, so as to know meaning, identity, and value. In sum, everyone has a God. Intricate symbol systems have grown and flourished among ancient and primitive peoples where nothing remotely like what we moderns would consider "science" was known or practiced. And equally intricate symbol systems have grown and flourished among modern, scientific folk. Human beings seem not to be more or less religious depending on the extent to which they are exposed to science. It is true that some of the old religions of the world have become extinct, but plenty of new ones have taken their place, most of them quite compatible with science.

Thesis 2 - While science and faith are distinct, and it has proven useful in human history to keep them distinct, it is impossible to separate them totally because all scientists are believers and all believers are scientists.

Definitions of science and faith are required if the distinction made in this thesis is to be meaningful. "Science" is defined as the study of cause and effect relationships observable in the physical world, for the purpose of learning as much as possible about how the universe is constructed and how it came to be. In this definition, the arena in which science works is limited to those things in the universe which can be sensed with either the five human senses or with the technology which assists those senses. "Faith" is both the basic trust that the world, as perceived from within any given symbol system, is a safe place to be, and an understanding of one's identity, meaning, and value within that world. Thus, science asks, "How does the world work and how did it come to be?" Faith asks, "Why is there a world at all? Why am I here? What must I do?"

The two remain distinct partly because if life does, indeed, have meaning, science has no way to determine what it is. Moreover, members of radically different faith communities find it possible to access the weight of stars or the molecular patterns of chromosomes without coming to different conclusions

because of differing religious beliefs.

Science and faith will never be separated completely, however, simply because the symbol system out of which one perceives the world determines what kinds of data one is able to sense in the world and thus examine scientifically. For example, my own rather common, Protestant symbol system keeps me from detecting with my senses things which others can sense. My friends in the "charismatic" communities within Christianity see and hear things around them which I do not see and hear. Native Americans with whom I have become familiar hear things which I do not hear. They can hear the stones of the earth speak to them. When I ask in either context why it is that I cannot hear these things and others can, I am informed that they expect to hear the voice of God, or they expect to hear the stones speak, and so they do. I do not hear because I do not expect. I can only conclude that human senses can detect only those things which they expect to detect or are prepared to detect, and I must therefore conclude further that science and religion will never be completely divorced. Every scientist perceives from within a symbol system whether he or she is aware of that perspective or not, and therefore any scientist is prepared and able to detect only that data which the symbol system allows.

Another factor which keeps faith and science from ever being fully disengaged is the reality that both rest upon assumptions and thus both in some ways are "religious" in nature. Science must assume that there is a natural cause or explanation for everything, one which can finally be studied by means of the human senses and reasoning powers with which to interpret sensory data. Devoid of that assumption, science would end up crippled or haphazard in its investigation and interpretation of the universe. Faith, too, rests upon the assumption that life does, in the end, have meaning. It is rationally conceivable, however, that the world is all an accident and life has no ultimate meaning, and it is equally conceivable that answers to questions about how the world works and how it began cannot be ascertained only by means of examining that much of the universe as can be sensed with human senses or aids to those senses.

Thesis 3 - Because science works so extensively in those things which give rise to religious beliefs --- the orderliness and intricacy of the universe, and the borderlines of the finite and infinite --- science inevitably demonstrates the rationality of religious beliefs.

We are concerned here (at this conference) with questions concerning the nature and extent of scientific defense of religious beliefs. I would contend that scientific investigation

inevitably and without attempting to do so gives rise to and supports religious beliefs. My evidence is the simple record of history. Ancient Assyrians studied the heavenly bodies and observed their orderly behavior. They were scientists, examining how the world works and using their senses to do that. One of their eventual successors, Thales, observed the heavenly bodies with enough care that he was able to predict successfully a solar eclipse in the 6th century BCE. But their observations also gave rise to the belief that because the heavenly bodies were so very dependable, they could be used for predicting the course of and understanding the meaning of human events. Aristotle and Plato, too, observed the orderliness of the cosmos and posited the theory that the structure of things suggested the existence of an uncaused first cause, an intelligent designing demiurge responsible for the existence of the world. "The heavens declare the glory of God," says the sky-watching shepherd psalmist in the Hebrew Scriptures. Thomas Aquinas in the 13th century AD revived Aristotle and put him in the service of Christian beliefs, thus offering what are to this day the soundest arguments for the existence of God --- the arguments from causation, change, contingency, design, and degrees of excellence.

It is also science which most consistently tantalizes human beings with glimpses of the boundaries between the finite and the infinite. Scientists probe the reaches of our infinitely expanding universe from the vantage point of our spot on this tiny speck of cosmic dust, Earth. Other scientists look into the cells of our living beings, seeing what is very near to the borderline of that which separates what is living from what is not living. In the face of such mysteries another fact of life emerges: Brushes with infinity tend to generate religious beliefs as well as religious and philosophical questions. The point once again, science without even trying to do so has always and still does demonstrate the reasonableness of religious belief and has even been known to generate religious beliefs.

Thesis 4 - While science demonstrates that it is reasonable to believe in the existence of a transcendent deity, or even a creator, neither science nor philosophy can provide proof that such a being exists.

The point to be made here is important, in a sense profound, but nevertheless simple. Arguments for the existence of a transcendent deity responsible for the existence of the world and thus for the world's value remain just that --- arguments. They are not proofs. It is as logical to argue that the chains of causation, change, and contingency are infinite, not finite, and that the intricate design of the universe and its creatures is an accidental wonder, the only source of its own meaning. At least from the perspective of us moderns in the western world,

positivist philosophers have made certain that arguments for the existence of something transcendent, something which cannot be measured or examined by human senses, remain arguments and not proofs. Indeed, such things whose existence cannot be either verified or falsified by means of human senses or their extensions, may not even be talked about meaningfully because if their existence cannot be determined as affecting anything, it makes no difference whether they exist or not. Ultimately, neither the scientist nor anybody else can finally provide incontrovertible evidence that there exists a transcendent being responsible for the world's existence, and only partly because the transcendent realm is outside the bounds in which science works, namely in the world perceptible to human senses.

Thesis 5 - Science is abused when it is put in the service of defending specific religious beliefs and metaphysical assumptions.

While it is inevitable that science will demonstrate the reasonableness of belief in a being who created, and perhaps even sustains, the universe, it is not the proper task of science to work in defense of certain more specific religious beliefs. I would personally argue that for science to be put in the service of defending specific religious beliefs could be illegitimate and an abuse of science, because that could be to take science hostage and force it to work from within a specific perspective of a particular symbol system. Were that to occur, it is highly likely that some data within the universe would not be taken into account because it could not be perceived from within the symbol system into which science had been taken hostage (see above, the argument concerning perception being dependent upon expectations as those are determined by one's symbol system).

In our modern world, it is science and scientists whom we ask to play the role of those who try, as much as is humanly possible, to do their work "outside" the constructs of symbol systems so that the unexpected might be finally observed, studied, and interpreted. As I understand the stories of such events, all of the great leaps of understanding in such fields as astronomy and physics have been first made by those who were, for whatever reason, able for a time to see what they did not expect, to see the world from a new and uncharted perspective. Granted, it is humanly impossible to live and work totally outside any and all symbol systems and still be able to communicate meaningfully with other human beings. Nevertheless, the task of doing so to the extent that it is possible is a necessary one, and one we entrust to science. If science is coopted, then the human race is poorer.

Thesis 6 - Religious belief is impoverished when it becomes dependent upon science for its credibility or allows science to determine the extent of its credibility.

At this point my pastoral instincts are most likely to show, and the concern of this thesis is mostly one of a Christian pastor and teacher who has watched hundreds of students make the hard journey from the first naivete of a black-and-white, unambiguous symbol system through the dark night of the soul's late adolescence, replete with all the frightening questions about identity and meaning, arriving finally at what will hopefully be a second naivete, a childlike faith, but now tolerant of and even blessed by ambiguities and uncertainties. It has been my experience that such journeys are hardest and most painful for those young people who have been taught somehow or another that science can be trusted to verify the unique reality of their particular symbol systems. I would contend that the type of science known to such a person is a science held hostage, and the religious convictions which attend such a faith are fragile as a result. All that needs happen for those convictions to be shattered is for them to be exposed to science which is not held hostage to the tight symbol system in which they were fostered. The result can be a young person unnecessarily frightened. If the world was not created in six 24-hour days, just as my Sunday School teacher said, then Christ is not raised and we are yet in our sins. And who am I? Food for worms. And maybe worse, I have been betrayed by those I trusted. What, and whom, can I believe now?

Thesis 7 - The central belief of Jews and Christians, (for example), that the universe belongs to a God who loves everything and everyone in it is outside the realm of those things which science can legitimately judge as rational or irrational.

At this point I speak from the specific perspective of a Christian theologian and pastor, and the central thesis to be argued is that the real heart of both Jewish and Christian faith is not so much whether there is a God, whether the universe was fashioned in six 24-hour days or six milliseconds or 6 billion years, whether there ever was a universal flood after which a boat might have been abandoned atop a mountain in Turkey, or even whether the shroud of Turin might once have covered the body of Jesus of Nazareth --- all of which, as stated above, science can help to determine the reasonableness of believing. The central belief of Jews and Christians is that God loves the world and every creature ever brought into being within it. Jews have clung for so many centuries to the belief that despite all appearances to the contrary --- despite Babylon, despite Rome, or

despite Auschwitz --- God is faithful. The central article of Christianity is stated differently by different Christians, but somehow or another all claim to have seen in the life, crucifixion, and resurrection of Jesus of Nazareth, God's heart, God's love, God's faithfulness. How could science ever measure the rationality of such things? Even if science could prove that Jesus rose from the dead, that is still a long way from proving that God is faithful, or that you and I might also rise from the dead. In sum, science can assist in determining the rationality of certain religious beliefs, including the belief that there exists a transcendent deity. But science cannot offer any assistance whatsoever in determining whether that deity, if he, she, or it exists, is kindly disposed or faithful toward human beings. Indeed, the most reasonable assessment of the deity whose existence science can help to demonstrate, is that the deity is responsible for an astonishing amount of suffering. "Nature," so intricately and wondrously made, "is red in tooth and claw."

Thesis 8 - The original intentions of the two creation accounts in Genesis were to foster beliefs which either need no defense or which science cannot defend.

This thesis and the discussion to follow is placed here as an illustration of sorts to further the arguments of the two preceding theses. The example of creation and the biblical creation accounts has been selected because it is one of the topics which has frequently occupied the conversation concerning how faith and science relate.

In order for you to understand my comments on the creation accounts in Genesis 1 and 2, I must tell you something of my perspective on the Scriptures. I understand virtually every document within the Scriptures, both the Hebrew and Christian Scriptures (Old Testament and New), to be pieces of problem-solving literature. That is, everything contained in the Bible was originally written so as to provide resources for the faith of Israel or the Church in some crisis or another. When reading an epistle of Paul or a book of Old Testament prophecy, that is usually obvious. But it is not immediately obvious when reading a narrative such as a New Testament gospel or the narratives of Genesis and Exodus. Careful study demonstrates, however, that Mark fashioned the story of Jesus in a certain way so as to give hope to a persecuted community. Luke did it another way so as to convince a politician that the Christians were not political insurrectionists.

Genesis, too, was first of all problem-solving literature, and assessment of what it properly means to say must begin with trying to understand the problem it was trying to solve. Without

going into the whole, long controversy over authorship and the age of the Genesis accounts, I would argue that no matter who one considers the author of the Genesis accounts to be, Moses for the whole thing, or a Priestly author and a Yahwist author (as proponents of the so-called "documentary hypothesis" argue) whose descriptions now appear together, one after the other, it is an unmistakable fact that there are two different "characterizations" of God in Genesis 1 and 2. In the first story, God is highly transcendent, creates by word, and is very much concerned with order and structure. In the second description, God is immanent, makes people and things by hand, operates by trial and error, and is concerned much more about loneliness than order and structure. It is also an unmistakable fact that there exist other ancient accounts of how the world came to be, and some of them, those known to us in the Enuma elish and the Gilgamesh Epic, have both striking similarities to and crucial differences from the Genesis narratives. Moreover, those two particular accounts were produced by the ancient Babylonian civilization out of which Abraham migrated to Palestine and into which Israel was taken captive when Jerusalem was destroyed in 587 BCE. Thus, it is reasonable to assume that the similarity of the accounts is due to some sort of association between Babylonian and Hebrew cultures.

I would argue that even more significant than the similarities between the two accounts, and what the implications of those similarities might be, are the differences between the accounts. For one thing, Genesis claims that not Marduk, but Yahweh, as Israel called its God, conquered chaos, provided order, and sustains the creation. For another, in the Babylonian account human beings were to be slaves so that the gods could have an eternal Sabbath, while in Genesis, human beings are given dominion of the earth and they, too, are given the Sabbath, the one day of the sequence whose end is not declared. And while in the Babylonian account of the universal flood, the gods smell the smoke of a sacrifice when the boat finally lands, and the gods spend the rest of "history" trying to kill the humans who survived (which explained why Babylonians had to continue offering sacrifices; they had to distract the gods!!), in Genesis Yahweh smells the smoke and realizes that he has missed that smell while water covered everything. He had been lonely, which is why he had created the world in the first place, so destruction would never do as a solution to the world's problems. Finally, the connection of Genesis 2's account of creation to the series of stories including the Fall, Cain's murdering Abel, the Flood, and Babel, all of them stories of sin, curse, and a dogged determination on God's part to keep the world going despite such problems, and finally the story of Abraham's call to come away so God could use him for the purpose of getting the world blessed instead of cursed, indicates that the whole sequence of Genesis 1 - 11 was not fashioned so as to answer the question of whether or not there was a God and whether or not the

world was a creation as opposed to an accident. Rather, it was meant to answer questions such as: Who rules the world, Marduk and Babylon, or the God of Israel? What is the role of humanity in the world? What does it mean to be an Israelite? Can God be trusted to remain faithful even when we disobey, play God, and murder our little brothers?

My point is simple. Science does not have the capacity to judge the reasonableness or unreasonableness of what those documents really meant to say to their first readers, and by extension to us latter day readers. The meaning of life and the faithfulness of God cannot be meaningfully evaluated by means of scientific method.

Thesis 9 - From a Christian perspective, unnecessary and dangerous confusions are generated when the validity of evolutionary theory is made an issue in the teaching of creation.

This point is pursuant to the preceding point, and it, too, is simple. In my opinion, if Genesis means to speak not about the subject of whether or not there is a transcendent deity and creator so much as about the meaning of life and the faithfulness of the God whose existence the narrative simply assumes, then Genesis is misused when it is held up as an "alternative" to a theory of evolution. I would even say that such a choice, which would sooner or later become a forced choice for anyone offered it in today's society, is not only a false choice but represents a dangerous circumstance for a person to face. If a person is forced to choose between Genesis and any and all evolutionary theory, then one is surely forced to choose between faith and reason, and for the sake of integrity a person may ultimately have to abandon one or the other.

Consequently, it seems to me to be something like planting time bombs within students to insist that elementary school textbooks present Genesis and evolutionary theories as alternatives to one another. Sooner or later that bomb will explode, usually in adolescence, and the result is most often that given the choice, people abandon the faith that had attached itself to a reading of Genesis as literal history, and at the same time they abandon not only the resources which Genesis originally intended to offer but too often as well their trust in the faithfulness of God. As an aside, I would say that the only way to keep the time bomb of false alternatives from exploding would be to offer an alternative not only to evolution but to the whole modern understanding of the world. Can you imagine television weather forecasting from a biblical perspective? Or medical and psychiatric care?

Thesis 10 - From a human perspective, when scientists, specifically in their vocation as scientists, engage in metaphysical speculation or apologetics on behalf of one religious belief system at the expense of other religious belief systems, the results too often are forms of chauvinism and bigotry which have no place in either science or religion.

I have already stated above that I believe that science put in the service of defending any particular belief system is science taken hostage and therefore science somewhat handicapped. Limited by the perspective of the symbol system out of which it operates, it can only perceive and interpret the data it expects to receive.

In a way I have escalated the argument considerably by adding in this last thesis words like "chauvinism" and "bigotry." Those are words which stir emotions, not all of them pleasant, but as I reflect upon my choice of them, it seems I chose them partly because of my own emotions, which have already been stirred up by the whole subject of which I speak. In all honesty, I must admit that I have strong suspicions about the motives of scientists who are eager to put science into the work of apologetics. I am afraid that many such people are really trying to find ways to prove their own view of the world, and their own religious beliefs, to be valid and to prove everybody else wrong, as though the world could be divided up between those who are right and those who are wrong or misinformed. I am also afraid, when I consider these matters, because my reading of history suggests that when people begin to divide up the world between those who are right and those who are wrong, the result is usually chauvinism, disrespect, bigotry, discrimination, war, and sometimes things like the Nazi holocaust.

I am also afraid for the individual welfare of those who find they must put science into the service of apologetics, because I think that the thirst for proof is an addiction which can never be satisfied and which, like any other addiction, can consume a human being. Such an addiction is especially dreadful, in my perception, because it entices its victims to be dependent not on those things which can give genuine meaning to life, things such as the love, forgiveness, and faithfulness of God, but to be dependent instead on the momentary highs experienced when one seems to have found a way to vindicate one's rightness.

We in modern society ask scientists to do a difficult thing. We ask them to be strong people, strong enough and brave enough to stand aside as best they can from their own symbol systems for long enough at a time to inspect the world from a variety of perspectives, and perchance to see the unexpected, to see, for example, that the earth is round, that bacteria cause disease, or that $E = mc^2$.

COMMENTS ON THE PAPER BY DR. NIEDNER.

The following comments ended up being much more extensive than I had originally intended. They do hopefully clarify the positions I take in my paper, and as such, one may consider them to be an addendum to my own paper. Similar remarks apply to my comments on Dr. Klotz's paper. The extensiveness of my comments on the papers by Drs. Klotz and Niedner compared to the brevity of comments on the papers by Dr. Brown and Mrs. Miles is a result of the fact that I have little disagreement with claims made by the latter, whereas I have endless disagreements with points made by the former.

Thesis 1:

(1) I agree that most religions flourish (belief in them continues to be widespread) whether or not science provides evidence confirming or disconfirming them. It does not follow, however, that that is the way things should be, particularly when the evidence is disconfirming. Most believers in religions have a largely mystical, non-publically-accessible evidential basis for their beliefs, despite the lip service given to various alleged public evidences. This includes large portions of the Christian community. Christianity is rather unusual, however, in that many of its foundational claims make assertions about publically accessible historical realities.

If religion is to provide any rational hope for such things as a life after death, etc., it seems to me that it has to be grounded in some form of persuasive, non-ambiguous, publically-accessible evidence, whether it be in the form of observables (in the loose sense of "things detectable by physical means") or rational argumentation based on observables. People can assert, as did Joseph Smith, that an angel or God appeared to them alone (private evidence --- alleged to be "physical", yet non-public), but one still has the problem of how one validates such an assertion if no publically-accessible evidence supporting the claim is available. Why should we believe Smith? How did Smith himself know his experience was veridical? Perhaps the supposed angels were projections of his subconscious mind. Perhaps he hallucinated. Perhaps the "angels" were "demons in disguise." Etc. Religious experiences establish nothing unless one can argue that they are what they appear to be. As with flying saucers, the Loch Ness monster, and so on, most scholars ask for physical evidence. In Joseph Smith's case there were the "gold tablets with heiroglyphics on them" which conveniently disappeared. Although such sources of justification technically need not necessarily be "science", they would be rather close to what one would call science.

Religious believers nearly always do have some type of evidence supporting their beliefs, but it is primarily subjective in nature. Catholics have their relics, Protestant fundamentalists have creationism, and the Hindus have the dramatic feats of their Yogins and Fakirs, but these things are nearly

always claimed to be incidental and for the benefit of non-believers. Subjectivistic evidences, on the other hand, are simply insufficient in themselves to warrant the degree of commitment made by religious believers. "Feelings" and "intuition" may serve as legitimate sources of initial hypotheses-to-be-tested, but they are very weak bases on which to found claims of justified belief in view of their uncertain origin and the fact that statistical tests seldom support their effectiveness. I feel very deeply that "love is right". I would almost say I "know" it is right better than I know anything else. But from whence cometh this feeling of knowledge? From subconscious memories of experiences in the womb? From deep desires that it be so? From yearnings acquired through the evolutionary history of my ancestors? I don't know. Can I arbitrarily reject all explanations of the origin of my feeling except the one that my feelings are communicating to me ontological truths?

Is it wise to base important decisions merely on intuition? Perhaps, if that were the only basis available. At least in regard to Christianity, however, that is not the situation we are in. On the other hand, if trust in intuitive methods themselves were grounded in persuasive, non-ambiguous, publically-accessible evidence, then perhaps evidence derived from them would be acceptable. Is such not the basis of ESP research --- the effort to justify intuitively-based beliefs by statistical tests on card guessing, etc.? Suppose we could indeed confirm that intuition worked "some of the time". How would we know that the time we made our religious commitments was the time it was "working"? In order to have rational confidence in decisions based on intuition, it seems that one would have to establish that intuition gives valid results more often than not. We would also have the problem of different people having contradictory intuitions. How do we judge who's intuition is more reasonable to trust? Are we not then again in the realm of scientific tests?

If one religion, say Christianity, is alleged to be the only correct one ("No one cometh to the Father but by Me."), then one may have a problem with the fact that many so-called "cults" and non-Christian religions flourish in such conditions too. All sorts of irrational and subjectivistic belief systems flourish when people are unwilling to allow the possibility of falsification and are unwilling to require that commitment to a belief should be in proportion to the net evidence (pro minus con) one has supporting its publically testable claims (if there are any). Keep in mind my sense of "falsification": a belief is "falsified" if it can be shown that one is justified in not "believing it" (making a commitment to it being "true"),i.e., if a commitment to the belief's falsity is justified by the available evidence. I am talking about justified belief and justified unbelief, not absolute truth and falsity.

Cults are often justified either by appeal to subjective "feelings" as opposed to more substantial evidence or by the invention or attachment of pseudosciences which agree in their conclusions with the cult's beliefs. Velikovsky's book Earth in Upheaval, for example, is presented by some religious groups as "scientific" evidence of the literal historical occurrence of the Biblical Flood of Gen. 6. Consciously or not, the motive, generally, seems to be more to avoid the pressure of disconfirming evidence arising in the genuine sciences rather than to say that their beliefs are rational judgments based on scientific evidence. Use of the appropriately chosen (confirming their beliefs) pseudoscience is a convenient way of avoiding falsification and providing pseudo-verification. "Establishment" geologists find no evidence for a global flood, yet Velikovsky finds tons of such evidence! The appropriate pseudoscience is an ad hoc addition to their worldview. It does not follow logically from the presuppositions of the worldview, and yet it does "explain" some of the uncomfortable facts that seem to falsify particular claims that do follow from the worldview.

The very fact that some religious groups use the pseudosciences in this way gives support to the claim that scientific evidence is treated as disconfirming of religious claims at times. There would be no "pressure" to avoid if scientific evidence were irrelevant.

I'm not saying that the pseudosciences themselves are necessarily unfalsifiable. I am saying that sciences and pseudosciences are selectively chosen on the basis of whether they confirm or disconfirm the beliefs already held, and not on the basis of some more intellectually honest criteria. Biology is "o.k." so long as it does not conflict with biblical claims. In the areas of conflict, one must chose some pseudo-biology that confirms the biblical claims.

(2) Yes, in a sense everyone has a religion. It is also true that in the early histories of religious commitments, science as understood at present did not exist. I would argue, however, that thinking in terms of evidence has always been a part of human thinking since man became man. Thinking rationally, of course, is not all that one means by doing science today.

It is important to distinguish the "context of discovery" from the "context of justification". Although I would claim otherwise, it is possible that the early Hebrews and Christians irrationally and unscientifically commited themselves to their religions. Just as it did not matter that Kekule "discovered" the structure of Benzene through the irrational intermediary of a dream, so it does not matter how the Hebrews and Christians originally came to their beliefs. What does matter though is how we justify our own similar commitments today. Given that Kekule saw carbon atoms joined in a circle in his dream, why did chemists

come to believe this structure actually corresponded to reality? They tested Kekule's hypothesis by appeal to both theory and experiment, reason and observation and found that it did indeed explain the properties of Benzene.

It is true that the example of Kekule does not deal with a foundational claim of chemistry. If quantum mechanics made no predictions about how carbon atoms must bond, then the discovered actual structure of Benzene would have no relevance to the accuracy of quantum mechanics. The fact is, however, that QM does make such claims and thus Kekule's discovery supports the theory of quantum mechanics. Similarly, in the case of the foundational claim of plenary inerrancy, e.g., there is a connection between the accuracy of the "particular, low level" claims (Jesus was born in Bethlehem) and the accuracy of the foundational claim.

Claims of plenary inerrancy do not represent much of modern theology or religion. On the other hand, for many even non-fundamentalist forms of religion there are certain claims that are both scientifically testable (potentially or in actuality) and that are treated as foundational themselves or as following from foundational claims by religious believers. Examples are the physical resurrection of Christ, the Virgin Birth, the Ascension, etc. Examples of appeals to evidence by Christian conservatives in support of the physical resurrection of Christ may be found in Josh McDowell's The Resurrection Factor (Here's Life Publishers, Inc., San Bernardino, CA, 1981) and Who Moved the Stone? by Frank Morison (Zondervan Publishing House, Grand Rapids, Mich., 1958). My references to these works are not intended as blanket acceptance of all views expressed by those authors. I disagree, e.g., with McDowell's characterization of and conclusions about the inefficacy of "the" scientific method.

(3) Human beings seem not to be more or less religious depending on the extent to which they are exposed to science because most religion (at least as it is manifested by the beliefs and interpretations of its adherents) is raw irrationalism that ignores falsifying evidence and rejoices in unjustified or weakly justified commitments to truth claims. On the other hand, exposure to science certainly has been a strong contributing factor in declines in commitment to fundamentalism. Is it not well known that, as Martin Gardner has pointed out, there are virtually no fundamentalist scholars of high academic rank in the science departments of the world's universities?

(4) Many modern religions are "compatible with science", but at what expense? They have thrown out historical and other testable claims as unimportant to the religion (the claims themselves may have "religious significance," but their historicity is unimportant) and have degenerated into irrationalistic or subjectivistic personal mysticisms.

It would seem odd to say, regarding the Virgin Birth and the Physical Resurrection of Christ, that it is "unimportant that they really happened in history." It is also rather clear that these two claims are not consistent with biological science as it is presently understood. We SHOULD be concerned by this inconsistency. If our accumulated experience says that such things don't happen, then we need to find weighty enough evidence to overrule our previous experience. As Carl Sagan and others have said, extraordinary claims require extraordinary evidence in their support since our experience with ordinary phenomena would tend to rule them out. The scientific "laws" of nature are epistemic and not necessarily ontological. Thus the fact that a human virgin birth violates the laws of biology as we understand them does not "prove" that such events have not occurred, but it does give us reason to doubt reports of such phenomena until the evidence for their occurrence warrants our overruling our accumulated human experience.

One could say, as many have, that since God is all-powerful, human virgin births are "no problem." Nothing would be a problem. Given the mere logical possibility of such a God bringing about such an event, however, does not make it likely that He did and does not show that the God explanation is preferable to alternative explanations. How does one verify or falsify that such a God has indeed acted in "nature" to bring about a virgin birth? Besides, the issue is, "did a human virgin birth occur" not "by what mechanism did it occur?"

Regarding the scientific testability of the all-powerful God mechanism, some would exclaim that surely here is a religious claim which could not be scientifically tested. What conceivable miracle could a being perform that would require INFINITE power? Perhaps none. As I have emphasized elsewhere, I do not intend to assert that all religious claims are scientifically verifiable or falsifiable anymore than I would claim that all claims in science are verifiable or falsifiable. There are, no doubt, claims which legitimately belong in the "negative heuristic" of Lakatos.

On the other hand, science is not incapable of dealing with infinite quantities. How do scientists verify that an object's mass becomes infinite when it reaches the speed of light? How do cosmologists deal with the singularities in the theory of black holes? The fact that something has attributes that are infinite does not necessarily put it in the exclusive realm of religion.

Why do physicists believe that the masses of electrons become "infinite" at the speed of light? At least partly because they have measured in the laboratory a mass vs. velocity curve that is exponentially increasing in agreement with Einstein's equation. Although one never can actually measure an infinite value, belief in the prediction of Einstein's equation that mass becomes infinite is warranted by what we can observe and measure.

Similarly, belief in the all-mightyness of a God might be warranted if one could establish that an intelligent agent of superhuman power was responsible for an event. Do not exobiologists believe they have scientific criteria whereby they can recognize the activity of an intelligent, alien being of superhuman power?

Thesis 2:

(5) Dr. Brown has already commented on Dr. Niedner's definition of science. Although Dr. Niedner is primarily dealing with religious "faith" in general, rather than Christian faith, one might ask whether his definition is representative of the Christian faith. I have always thought that biblical "faith" is a trust in the person of God or Christ ("faith in ...") and in the accuracy of that person's statements ("faith that ..."). As I understand him, Dr. Niedner is using "faith" as a synonym for "religion," thus a broader definition is required.

It is common to say that religion ("faith") answers why and science answers how, but such a view is highly simplistic. One can admit that the scriptures are not concerned with the detailed mechanisms of phenomena, whether they be the motions of the planets or the mechanism involved in raising the body of Christ from death to physical life. On the other hand, I think it is very questionable whether Christianity is concerned only with the religious "meaning" of events, and not their historicity as well. What good does it do us if Christ's resurrection means that we can have hope of our own resurrection, when Christ's never really occurred? If Christ's body was not revived, what hope do we have that our's will be? Why should I follow what the scriptures say if I have no good reason to believe the scripture writers were in touch with reality?

(6) Dr. Niedner remarks that his symbol system keeps him from seeing and hearing things which others can see and hear. He notes that charismatics see and hear things he does not. Shouldn't he rather say that the charismatics CLAIM to see and hear such things? He is talking as if people have different "realities" which, though perhaps mutually exclusive, are nonetheless all "right." Although modern philosophy of science might admit that what different people see and hear is shaped by their "symbol systems" (the so-called "theory-ladenness" of observation), I wonder whether they are saying the same thing as Dr. Niedner is.

It is confusing to talk of "seeing and hearing" when it is clear from context that he is using these terms metaphorically. Saying that the stones of the earth literally speak would be a return to an animistic view of nature. I think most scholars would say that stones do not speak to anyone --- there is no evidence supporting such a claim. The Native Americans are

either (a) speaking metaphorically in the sense that nature gives us information about itself, (b) speaking literally, but founding their claims on a personal, mystical perception of "sound", (c) speaking literally and objectively, in which case most scholars would simply say the Native Americans are "wrong".

To some extent we do not see what we do not expect to see. There is a sense in which our theories "decide" what we can "see". Surely one sees an unexpected guest when they come to your door however. Lack of expectation does not make us blind. I would agree with Dr. Niedner that if, for example, science presupposes naturalism, then scientists can never observe a "supernatural" phenomenon since it is never one of the choices one has as a solution to a problem. One would always opt for a natural explanation, no matter how improbable. If no natural explanation was available to explain some phenomenon, then it simply would be labeled "unexplained" not "supernatural".

Thesis 3:

(7) To the extent that science demonstrates the orderliness and intricacy of the universe, it might confirm the religious belief that the universe is orderly and intricate. However, science does not inevitably demonstrate the rationality of religious beliefs. In the first place, if it does confirm order and intricacy, it confirms only these two religious beliefs, and not all religious beliefs. Certainly these two religious beliefs do not distinguish Christianity from innumerable other religions. Christianity involves many other much more specific religious claims that are not so obviously confirmed. Also, some scholars would question whether order and intricacy of the universe are inherently "religious" claims.

The conclusion of most quantum mechanicians that nature is, at its foundations, ruled by the laws of probability rather than by deterministic laws might be construed to confirm a LACK of orderliness inherent in nature. The second law of thermodynamics can also be noted as strong evidence of disordering tendencies in the universe. Do such disordering tendencies disconfirm religious claims?

Thesis 4:

(8) My understanding is that the issue of "absolute proof" has long been dead, certainly in science. Proof as it is understood by scholars today means "convincing evidence". There exists "proof" of a claim if there exists evidence which convinces someone, although in science the someone should be the scientific community as a whole. A theory has been "proved" if the weight of existing evidence is strongly in favor of the theory in the judgment of the majority of scientists. Note that one can't just say there is "evidence for" something, since what counts as

evidence has to be decided in the context of a particular paradigm. It is possible that scientists are wrong when they say the earth revolves about the sun. The weight of the evidence, however, has thoroughly convinced the vast majority of scientists that it does. Note that "proved" claims can later turn out to be wrong. Scientists are seeking the best judgment based on available evidence. Scientists are after rationally justified belief rather than "absolute" knowledge not because they would not desire to have absolute knowledge, but because it is regarded as unattainable. Rationally justified belief is the closest approximation to absolute knowledge available to humans. We may not be able to "know we know", but we can have rational confidence that we know. What I mean is that our rationally justified belief may in fact be the way the world "truly" is, but I don't see how we can ever be certain of this correspondence.

I do believe, nonetheless, that the scientific rational weighing of evidence coupled as much as possible with experimental test does lead to genuine progress in telling us "true" things about the world, although there may be ups and downs in the overall upward trend. I don't believe that scientific models are merely a "random walk" in our ideas about the world. They are not mere "calculational devices," although some of contemporary quantum mechanics may be of that nature. Perhaps a "limited" random walk might be accurate though, much as a photon "random walks" inside the sun but eventually escapes from the sun's photosphere.

We do not have "incontrovertible" evidence that dinosaurs existed, yet the evidence that does exist is sufficiently persuasive in the judgment of most scientists that their existence in the past is accepted as "fact" and not just as a "guess" or "irrational belief." Also, as Ian Barbour notes in his Issues in Science and Religion, dinosaurs are not convenient fictions whereby we organize the fossil data. They are regarded as real entities existing in the past. Black holes provide another illustration of objects asserted to exist by many scientists despite the absence of "incontrovertible" evidence. Our inability to provide "incontrovertible" evidence for the existence of something is never an issue.

(9) It is also debatable whether the Christian God is transcendent to the extent Dr. Niedner seems to imply. Of course, one might insist that Dr. Niedner isn't claiming to be speaking of the Christian Deity, which is possible. It seems strange, however, that so many of his arguments seem to be dealing with conceptions that are not representative (from my perspective of course) of Christianity, given that Dr. Niedner is an avowed Christian theologian.

Surely the Incarnation is a foundational Christian belief. Was not the Incarnation an example of the immanence of God --- God

manifesting Himself in material reality? Perhaps we should deny that Christ was the second person of the Trinity? --- That way we could still have a transcendent Deity.

Then there is the Shekinah Glory. Throughout biblical history God is presented as literally dwelling with His people in the pillar of fire, the Burning Bush, the light at the Mt. of Transfiguration, and the light above the brightness of the noon-day sun that confronted Saul on the road to Damascus. Although this was not thought to be God "in His fulness" ("The heaven and even the heaven of heavens cannot contain Thee" according to Solomon at the dedication of the Temple), it was genuinely regarded as God Himself appearing to man in theophanic Glory. But then, we could say this is all biblical mythology, not to be taken literally. Was the Incarnation merely a literary device ("myth")?

Rather than write a book to effectively respond to Dr. Niedner's viewpoints, I rather refer the reader to a classic text: The Immanence of God in Rabbinical Literature by J. Abelson (Macmillan and Co., London, 1912). I do not intend by this reference to imply that the reference necessary supports the position I have been taking. I wish only to direct the reader to one of the more extensive works on the theophanies from a Rabbinical perspective. Gershom Scholem and Meredith Kline have written on the Shekinah as well.

Thesis 5:

(10) Let me suppose that some approximation to Dr. Niedner's "symbol systems" would be Kuhnian "paradigms." Dr. Niedner argues that science should not be used to defend specific religious beliefs because science would be forced to work within a particular paradigm and, as a result, some data would be ignored since within that particular paradigm that data would not be seen as significant. I would claim, however, that science is always done within a particular paradigm, as is theology, despite the fact that, yes, certain data about the universe is inevitably ignored. There are no "paradigm-free" thought systems. Dr. Niedner's illustration of the great leaps in understanding (scientific revolutions) in astronomy and physics alleges that the revolutions occurred because scientists were able to some extent to free themselves from any paradigm dependance and "see things more clearly". His use of words, however, only confirms that "seeing from a new and uncharted perspective" is not being paradigm-free, but rather is a shift to a different paradigm. Yet paradigm shifts are the very thing he argues should be avoided, because they would "take science hostage." Science (and all scholarship for that matter) is always a hostage, it merely changes masters every so often.

Thesis 6:

(11) It is true that those who submit their religious claims to scientific test (to the extent to which that is possible) do indeed have a more "fragile" set of religious convictions. Falsifiable beliefs are "more fragile" than unfalsifiable ones. The advantage of having falsifiable beliefs is that one can at least have some rational confidence in their correctness if the evidence favors them. If the evidence does not favor them, then why choose to commit our lives to them? Because we WANT them to be so? We can all choose to believe that we will never physically die. That would be nice and it might help us feel strong and confident as we grow older. But it would be delusion! We have all sorts of evidence that we indeed will die. Other humans around us are constantly dying. We are of the same flesh. Etc. etc. Notice also that no matter how secure this delusion might make us feel, it could be very damaging as well. We might take foolish risks thinking we were invulnerable for example. We might live our lives much differently if we didn't ignore the evidence of the unpleasant truth that we shall surely die.

Perhaps we will go through an emotional crisis when the fact of our mortality starts to really sink in, usually in middle age. Many people have gone through such hurtful crises in middle age. Should we commit ourselves to fairy tales in order to avoid such crises? Religious convictions which are not justified by supporting evidence should be shattered. It may shatter a child's comfortable world to learn that Santa Claus is not real, but he will mature in the process and hopefully come to base his security on more secure foundations. If no such foundations exist, then the rational person should be insecure. If the evidence overwhelmingly favors that we are "food for worms", then we must bravely face that rational conclusion despite its depressing, morbid nature. Maybe we really have been betrayed by those we've trusted. Such events have indeed happened in the history of our world! Of course we could always take dope to avoid the fears and anxieties of the real world. Is that what we want?

It certainly is not logically entailed by a falsification of the claim that the Earth was created in six 24-hr. days that Christ is not raised and we are still in our sins. If the Christian student concluded it did, their reasoning would be in error and it would be the Christian counselor's responsibility to explain the error in reasoning. Other than pointing out the logical error, one could also argue that it is not necessary to interpret the biblical text in the literal sense, and thus the falsification would merely destroy a "straw man."

If one regards the scripture as "the inspired Word of God" (plenary inspiration), then it does follow that falsification of any part (assuming that part has been interpreted correctly) ---

even "purely" historical, "non-religious" parts --- casts doubt on the authority of all the remaining claims. Even if one does not hold a plenary view of inspiration, a considerable loss of confidence in the authority of biblical statements, including those dealing with morals and ethics, rationally should follow repeated falsifications of those biblical claims which are subject to falsification (historical and scientific claims).

If one insists that there is no connection between the correctness of biblical historical claims and the correctness of biblical moral claims, the question arises as to how one validates the moral claims. I would argue that a basis of subjective feelings and mystical insights is a foundation of sand. An irrational leap of faith is even worse. Although the accuracy of biblical historical claims does not logically entail the accuracy of biblical moral claims, it is certainly more justified to extrapolate global trust from an evidentially confirmed basis than it is to make moral truth claims without such a base.

To illustrate what I mean, consider talking to Albert Einstein about politics. Most people are aware that Einstein would be a good person to trust if we were talking to him about issues in physics. Einstein's work has been repeatedly confirmed as to its accuracy. Conversely, it is certainly true that often a scholar is extremely ignorant of areas outside his particular field of expertise. This ignorance, though, is primarily due to lack of training rather than lack of ability to think carefully about those areas. It is a fact that books have been written with titles like "Einstein on Peace." Somebody must care what Einstein thought on those matters.

Why give Einstein's views any more weight than Joe Smo's? Apparently the thought is that if a person is a genius in one area, he will tend to be unusually perceptive in other areas as well, given that he has trained himself in the relevant issues. Most of us would be more open to considering what Einstein had to say than to considering what Joe Smo had to say. Similarly, it would be reasonable to be more open to considering what the Bible has to say about morals if its historical claims are found to be infallible than if its historical claims are invariably falsified. Repeated disconfirmations of biblical claims should cast doubt on the presuppositions on which the biblical worldview is based. If the worldview is made doubtful, then so are the moral claims that arise in that worldview.

It is important to notice that both the historical and the moral claims are claims made by the same people. Assuming for the sake of argument that the Bible is merely a compendium of the religious philosophies and feelings of the Hebrews and early Christians and not divinely authored in any sense, why should we trust the authors when they express their moral truth claims if we can't trust their judgment, intuition, inspiration, or whatever

when they make historical claims?

Thesis 7:

(12) I would question that the "central" belief of Christians is that the universe belongs to a God who loves everything and everyone in it. I thought the central belief of Christianity was that God so loved "the world" that He gave His only begotten Son, that whosoever believes in Him should have eternal life (John 3:16). It is clear from scripture that "the world" that God loves does not include sin and evil. Sin and evil are in the universe, yet God "hates" them. My main concern is that Dr. Niedner seems to make God's love more central to Christianity than Christ Himself is.

It is not obvious to me whether a claim like "God loves humans" is scientifically investigable or not. If one considers psychology a "science", one might ask whether a psychologist could answer the question "Does John love Sarah?". I think there are detectable evidences, confirming and disconfirming, of the presence of love in a relationship. "You just laid down your life for me, therefore you love me." "You just had sex with my best friend in our own bed in my presence, therefore you do not love me." Love is not just a "mystical bond between lovers". Mature people constantly appeal to evidence when they argue the presence or absence of love.

The fact that the "problem of evil" so concerns many Christians goes to show that some people regard the claim that God loves as falsifiable, even though they might deny such falsifiability if asked point blank. It seems to me that the evidence that gives rise to the problem of evil is indeed disconfirming of the claim that there is an almighty, all-loving God who is overseeing the world. It is perhaps moot whether such evidence is "scientific" or not, but it seems to me that it might very well be of that nature.

Dr. Niedner, in noting that "nature is red in tooth and claw", shows awareness of this disconfirming evidence acquired through scientific observation of the world. He admits that "the most reasonable assessment of the deity", as derived from scientific examination of the world, is a deity who "is responsible for an astonishing amount of suffering." Yet he seems to ignore this evidence as somehow irrelevant. Is what is most reasonable "irrelevant"? It's almost as if he is saying that if science leads to disconfirming evidence, we must ignore that, but if it provides confirming evidence, then "science can assist in determining the rationality of certain religious beliefs".

Another point is that if one means by "central beliefs" the same thing as "fundamental presuppositions", then science has its "central beliefs" that are metaphysical as well. The "success" of

the scientific enterprise, however, can be seen as evidence that at least "suggests" the accuracy of the founding presuppositions. Repeated disconfirmations of scientific claims would certainly cast doubt on the accuracy of the presuppositions on which the enterprise is based.

A final point is that the "central thesis" is not the only important one. Even if the central thesis were completely unverifiable and unfalsifiable, there are many other important claims that are subject to scientific test. Allowing that the central thesis of most religions is that God loves us, this claim does not distinguish Christianity from Judaism, Islam, and many other non-Christian viewpoints. Some of the claims which provide demarcation criteria are not nearly as presuppositional as the claim Dr. Niedner uses to argue his point.

Thesis 8:

(13) I do not wish to embroil myself in the arguments over the intent of the writer(s) of Genesis. Certain arguments are inevitably put forth in that discussion, however, that need more careful examination. There does not seem to be any distinction made between primary intent and incidental factual statement. Simply because my primary intent in writing a letter to my wife is to say "I love you" does not mean that my statement that my car's engine blew up today on the way to work is a non-historical event the veracity of which is irrelevant. I may have wanted to communicate many things in my letter.

If my son asks my wife whether I will be home on time, she might say "probably not, since dad's having car trouble." Simply because she recognizes my primary intent in writing the letter was not to tell her about my car trouble does not mean that the contents of my letter can't be used to refute the child's assertion that dad will indeed be home on time, since he told the child this morning that he would be.

Perhaps God knew that at some point in history man would need to know something about his physical origin. Genesis would still be problem-solving literature.

Dr. Niedner's implied opposition of "faith and reason" is typical of those who regard religious faith as an irrational, subjectivistic, or mystical commitment. As I have argued in my own paper, I think this is a great error. If a particular faith is strongly disconfirmed by tons of evidence, then indeed we should abandon it. The fact that Christianity, in my view, is not based on an irrational, subjectivistic, or mystical faith is one good reason supporting rational commitment to its claims over those of other religions and worldviews.

Thesis 9:

(14) Dr. Niedner asks "Can you imagine television weather forecasting from a biblical perspective? Or medical and psychiatric care?".

Yes, I can. Newton's laws governing fluid mechanics are not contrary to the Bible. One would still refer to high pressure systems, cold fronts, tornadoes, temperature, etc. in much the same way we do now. Biblical meteorology would not be significantly different from the meteorology we have today (although paleometeorology might be very different). At least in their areas of overlap between religion and science, truth is truth. There is not "religious truth" and "scientific truth".

Does not the Oral Roberts medical organization and hospital use nearly all of modern scientific language and healing techniques, with a few additional ones like prayer? Oral Roberts thinks he is doing "biblical medical care".

Similarly, the creationists emphasize that they are not denying the factuality of most of neo-biology, neo-geology, neo-astronomy etc., based as they are on experiment and "direct" observation. Rather, they mainly object to prehistorical extrapolations of science based on philosophical presuppositions such as uniformitarianism, which, although valid for much of man's history, was not valid many thousands of years ago in their view.

Thesis 10:

(15) The motives that individuals have for using scientific evidence to reinforce any beliefs are in some sense irrelevant. If Shockley is indeed a racist, that does not invalidate his arguments that blacks are inferior to whites in intelligence. The evidence is either there or it isn't. Now one probably should be very careful in examining Shockley's data if one suspects that he may have strong motives for deceptively manipulating the data so that it supports his own allegedly irrational a priori conclusions. I would hope that all people would want to find ways to prove their own view of the world as well as their own religious beliefs. Otherwise they must hold them in the absence of good evidential support. In some sense they should want to prove other world views "wrong" as well. It does not follow that they must be hateful or deceptive about how they go about accomplishing this feat.

The world to a large extent can be divided up into those who have strong evidential support for their beliefs and those who do not. Again, I'm not talking about "absolutely right" and "absolutely wrong". Absolute claims apparently are indeed unjustifiable. Is it unscholarly to insist that Flat Earthers are "wrong"? If Christ is the promised Messiah, then the Jews are

wrong no matter how tolerant we'd like to be. Admittedly there are "grey areas" where the evidence has not warranted strong commitment to any particular side of the issue.

The fact that irrational commitments often lead to such things as war does not mean we should give up trying to arrive at rationally motivated commitments. The very examples Dr. Niedner uses involve the presumption that such things as disrespect, discrimination, and war are "wrong." Surely the assertion that the Nazi holocaust is wrong divides the world between the Nazis and the non-Nazis, the presumably wrong (the Nazis) and the right (the non-Nazis). Also, it seems clear that disrespect is sometimes rationally warranted behavior as is discrimination. For example, it is quite just, in the view of most people, to lack respect for the husband who beats his wife and children, is unwilling to work, steals from his boss, etc. At least in science classes, when we give people grades we are "discriminating" between those who have studied well and those who have not. In the case of war, most people have always argued that some things are worth fighting for, whether it is the sanctity of the family, the safety of one's children, or a just legal system. Were we not fighting battles in an ideological war in this very conference?

(16) I think most scholars have a thirst for "proof" and legitimately so. If we don't thirst for complete justification of our beliefs, what is the alternative --- put our trust in beliefs that may very well be fairy tales? What peace can a rational individual have in such commitments? I would agree that this search can become an addiction and it should. Addiction, of course, is a rather manipulative word since its usual useage is negative in its connotation. "Thirsting for the truth" is a bad thing? I would also agree that "complete" justification is perhaps unattainable in practice. Should we "thirst after righteousness" in this life, even though it is unattainable?

Although "the love, forgiveness, and faithfulness of God" might give meaning to life, the question that concerns me is whether this meaning is "genuine". The Moslem no doubt <u>feels</u> that his life has been made (subjectively) meaningful by his trust in Allah. Whether our lives have ontological meaning, for the Christian anyway, would seem very dependent on the truth of such claims as "God exists", "God is loving", "God is faithful", and "God is very powerful, if not all-powerful". Should we seek to learn the truth of these claims?

It seems as if Dr. Niedner is assuming that these things are already known to be true by some sort of mystical awareness. That's why we don't need to seek to know the truth. It is already known! Or, perhaps we should seek this "mystical awareness"? I do not intend to deny that Christianity has a mystical element. On the other hand, I sincerely hope that is not its primary or sole source of justification.

It is sometimes argued that the fundamental distinction between science and religion is that religion involves commitment to a person rather than commitment to an idea. One does not decide to marry a particular person from a rational weighing of evidence it is asserted. So similarly, it is said that one should not "accept Jesus into one's heart" by a rational weighing of evidence. When should one make a commitment to a person? Certainly at the minimum one should insist on strong evidence that the person exists! What "meaning" can a relationship with a non-existent person have? We don't discern the existence of our future wives or husbands by "mystical awareness" either. Given our prospective spouse's existence, how should we decide whether making a life commitment is a wise thing? Do not we weigh evidences such as how genuine our love is for each other, what the mate's parents are like, advice from friends and relatives, the mate's ability to handle emotional stresses, the mate's good and bad qualities and whether we could tolerate the bad, does the mate have AIDS, what is the probability of faithfulness, wisdom in handling money, does the mate have similar values, ideals, and philosophies, etc.? Don't pre-marital counselors advise prospective mates to consider carefully these type of things before making a commitment to marry? Although there may be moral reason for not taking the route, some even recommend "experimental pre-marital test" (living together out of wedlock)! Is not marriage based purely on emotional infatuation ("feelings") considered very unwise, although sometimes by "chance" it might "work out"? One should not keep avoiding commitment until one has "complete justification," but the more positive evidence one can accumulate on which to base the leap of commitment the wiser the leap will be.

It seems to me that assertions like "God is all-good" can be rationally justified in the following way. Note that they represent a very small part of the many propositions making up the Christian worldview. Although individual claims sometimes are beyond direct confirmation through evidence, many of the other propositions and assertions (e.g., historical claims) of the worldview can be evaluated by appeal to direct evidence. If these claims are strongly confirmed relative to the degree of similar confirmation of alternative worldviews, then we are rationally justified in believing the more intangible truth claims of this particular worldview. In other words, the overall worldview is a justified belief if "enough" of its assertions have been confirmed. Thus, certain claims (e.g., metaphysical claims which are intimately connected with the equations) of relativity theory are very difficult to submit to experimental test, yet they tentatively are accepted as "true" because the theory in many important ways has been repeatedly confirmed by numerous types of experiments which tested the more accessible predictions of the theory. Similarly, most scientists in practice believe that the metaphysical claim that "God does play dice" is justifiable in preference to Einstein's claim that God does not "play dice." The

Copenhagen interpretation of quantum mechanics is accepted as rationally justified and not merely on the basis of a mystical sense.

Some of the propositions of the worldview may be disconfirmed in our best judgment, but that would not necessitate rejection of the worldview by rational people. Rather, such disconfirmations would count as "anomalies" which, if they mounted up sufficiently, might eventually require a rejection of the worldview in a "worldview revolution" ("paradigm shift"?). Such anomalies might be treated with ad hoc explanations until the "ad hoc"-ness of the worldview became excessive relative to competing worldviews. Isn't this the pattern followed by scientific paradigms?

One can rationally commit oneself to the belief that God is loving, forgiving, and faithful at the same time that one is seeking further confirmation for the Christian worldview provided one has a good evidential foundation for the worldview. One need not, therefore, become a "reed in the wind" when sometimes one confirms a worldview proposition and at other times one disconfirms a worldview proposition. We will probably have a positive emotional reaction when we see confirmations, and negative emotional reactions when we see disconfirmations. Unless however, these oscillations in evidential support become a unidirectional trend to disconfirmation, we can still remain "believers" and yet be rational.

(17) I would like to end my comments on Dr. Niedner's paper by emphasizing that I intend my comments as a scholarly response to issues and arguments he raises and neither as an attack on Dr. Niedner as a person nor as a denial of his genuine stature in the academic community. It is clear that we disagree on many issues. Also, we both feel strongly the validity of our own positions. Some of my comments might be interpreted as ridicule or personal attacks, but I certainly did not intend them that way. Readers should keep in mind as well that I have no formal training in theology or philosophy of science or religion, although I have read widely in these areas.

I encourage readers to interact with us by mail or phone or by publishing articles of their own in response to ours so that we all can make progress in understanding these rather complex issues.

COMMENTS MADE DURING THE QUESTION-AND-ANSWER PERIOD

The following is as accurate a direct transcription from casette tape of the panel discussion period as I could make given that some people in the audience spoke faintly at times and so on. I've made no attempt to correct English, etc.

The discussion begins following a remark by Dr. Klotz on the difficulty of obtaining scientific information about past events:

Question to Dr. Brown: How does science deal with past events in the light of the need to have testability, repeatability, verifiability, ...?

Dr. Brown: There are lots of things to say. First of all ... the idea that scientists must do experiments, where experiments mean creating a controlled environment, is simply not correct ...The oldest science is astronomy and astronomers do preciously few experiments in the sense of creating a controlled environment.

Repeatability and testability can come in many different ways. One of the things that is being debated right now, and this is perhaps as good an example as any, is whether --- I'm not very good at geological labels --- but whether the dinosaurs disappeared because of an impact of an extraterrestrial object, possibly a comet on the earth, which threw a lot of dust in the air and blocked out the sun. And that's a historical event. How would one go about trying to test that? If the event occurred, it left behind an enormous number of effects. This particular discussion began in the first place because a particular layer of iridium was found between two geological strata and this was totally anomalous --- there could not be any good reason for it being there.

The proposal itself has led to a large number of further proposals and further tests, i.e., events in the past leave present effects and one can test whether or not those effects have occurred in much the same way that one can carry this out in any other observational science. There's no special bar, in that regard, between present effects and past effects.

Astronomers only look at past effects. I mean, take seriously the size of the universe and the finite speed of light. An astronomer who looks at a quasar a million light years away is looking a million years back into the past and is seeing now energy patterns that existed at that time. The whole question of cosmogony first became respectable to physicists and astronomers a few years ago. The reason was the discovery of the 3^{o} background radiation, i.e., there is a pervasive background radiation throughout the universe which can be thought of as a thermal radiation with a temperature of about 3^{o} Kelvin.

This is the first time that scientists sat up and said, "if the Big Bang occurred, we are now seeing a clearly understandable effect of it." --- a subject matter going way back as far as you want to the origins of the universe. Current physics gives us no good reason why there should be more matter than antimatter in the universe, and yet if they were equal they should have annihilated each other. One of the things that makes current versions of cosmology interesting is people now think they have a way of building theories which will in fact explain the imbalance of matter and antimatter in the universe.

What I'm getting at is, all of these theories are tested by presently measurable effects.

Let me add the other side, by the way. I'm not sure what Dr. Klotz meant by "our present time frame," "our present time level," but the same thing goes with Newton's predictions into the future. It's one thing to say that a particular scientist made a prediction off the top of his head that turned out to be false. I would take a better example of a scientific prediction, that at least in the next few hours Bernoulli's principle will continue to hold and so that Dr. Klotz's plane will fly.

Question to Mrs. Miles: You talked a little bit ago, and this is in response to Dr. Klotz, about the Kuhnian revolutions and this had to do with the question about, I think Dr. Klotz suggested that science basically tends to be resistant to changes when some things come along that suggest that older ideas are untrue and you brought in Kuhnian revolutions.

I'd like to suggest and have you comment that there are two different aspects of that. I mean one is the idea that we have fields which are in a state of flux. You do have examples where things do change rapidly, and an example is elementary particle physics where people have theories that stay around 2 or 3 years and if they don't work, they are forgotten about ... versus the other situation where you got this paradigm which Dr. Kuhn talked about --- or his paradigm shifts, e.g., the nineteenth century mechanical view of things --- everything could be explained in mechanical terms and ... there was certainly at that time many people resistant to the idea of abandoning these things because they had carried them so far and so maybe there was a period where resistance to change had built up and then there was a major revolution where that was abandoned.

Could you perhaps talk about the ... [?] or are scientists just as ... resistant to change?

Mrs. Miles: Yes... It seems to me it depends an awful lot on what your view of science is, what your view of the history of

science is, I mean, we're going to have to go back and make a whole lot of presuppositional statements that we have to agree on before I can tell you whether or not we can discuss how conservative is science, how open to change it is.

I think that science or the scientific community hold both of these in tension. I think science, by its nature, should be conservative because every time we get an anomalous bit of data we don't want to throw it out and go chasing after a bad meter in our lab, right? So that there is a point at which we have to maintain a conservative stance.

On the other hand, once we begin to learn things in a particular way it's very difficult for us not to try and force everything, every bit of data, into that. And so we find new ways of crunching the data in our statistics, programming our computer to come out with something that is a little closer to our field [?], our hypothesis, our thesis, our paradigm. I think that there are some fields that are going to be less conservative simply because the state of certainty is less. I mean, you go into certain fields and you know that everything is "up for grabs" ...

I don't know physics that well, ... but when you take the length of time that it takes for specific data or theory, not just the data, to get into a graduate school program --- 12, 15, 20 years to move from the [... ? ...] to accepting that at the graduate school level. How long did it take to get DNA and not protein out of the chromosomes? I think that there is a long time ...

When I graduated from Ball State in 60 we weren't discussing DNA ... that may say something about Ball State ... I talked to a number of my colleagues who were in other universities and they weren't ... DNA either ...

There is this conservative period in which goes on teaching the old.

Dr. Brown: May I make a comment about this briefly? Since this comes in terms of Kuhn, it is perhaps worth mentioning that Kuhn wrote an essay, which he then later used as the title for a collection of his essays, called The Essential Tension. A major part of his point, consistent with what Mrs. Miles just said, is that science runs on a tension between conservatism and innovation. You don't want to ignore innovation, but you don't want to throw out a powerful theory just because you think you got a counter-instance. And there's a much richer and much more complex interplay. And, this is one of the things that's partly ignored by everybody that reads Kuhn, partly his own fault.... The Essential Tension was actually written before The Structure

of Scientific Revolutions and then used as the title essay in the book several years later. This has run throughout his thought. Don't forget that paradigm shifts do happen according to Kuhn. There's always this interplay between knowing what to do with new data and knowing when to throw out a theory and when not. Part of Kuhn's whole point is that, contrary to earlier views of science, there is no rule that allows you to sit down and calculate it. There's always this subtle complex interplay. It's not simply a matter of one or the other.

Response from Dr. Klotz: I want to comment on the earlier exchange. You know, when you look at the dinosaurs, and I'm going to use this as an example of how we work with the past, I can remember and maybe you can too, when the theory was that they had been destroyed by the newly-developed mammals that were eating their eggs. The other explanation, and I don't know which one came first, was that they were carnivorus and they killed each other off. Now we're talking about the idea of some heavenly body. I've seen the materials with the iridium layer and I think that we have some rather interesting, intriguing explanations that are based on that. I think we have some evidence which fits with that, in other words, we would not disagree with the factual evidence on which this explanation is built. But I would suggest that it's too early to say that we have the final answer, and I'm sure that Dr. Brown ... would agree with that too. We're not at all sure that we have the final answer. Now, when you come to the extinction of an organism on our time level, I think we're pretty well able to answer. Let's say the California condor, which seems to be on the way out. I think we can have a pretty good answer as to why that bird is becoming extinct. And it would be, I think to me, much more satisfying than this explanation of a heavenly body impacting on the earth and destroying the dinosaurs. Now again, I'm not denying that possibility. I'm just saying, I'm more satisfied with the information we have on what's causing the extinction of the condors on our time level than I am with the evidence as to what wiped out the dinosaurs.

The other thing is, I guess, this idea of predicting the immediate future and what will hold. I think that fits pretty much with what I was trying to say at the beginning --- that both religion --- our Judeo-Christian approach --- and science accept uniformity and it's because of uniformity that we expect such a thing as an airplane to fly. Of course we accept that and see that, but that's a different thing from some of these predictions as to what the future holds. Now, I find them interesting. I find a grain of truth in a lot of them. But look at the predictions for the world of 1980 that were issued in 1970. Look at the predictions for the world of 1990 that were issued, some of these by scientists, ... issued in 1980 for the world of 1990. We just don't have the validity and reliability when we deal with

the future that we do when we're dealing with the present.

Ron Pine: My name is Ronald Pine, I have training in biology and I have been an avid student but not a devotee of scientific creationism for many years.

Just a little bit about extinctions. The idea that the dinosaurs were wiped out by newly evolved mammals I think was an idea that was mostly in semi-popular books, and not one that was advocated by scientists or specialists in the field. For one thing, 2/3 of the past history of mammals on the earth, according to our understanding of it (don't forget I'm an evolutionist), 2/3 of the period of time that mammals have been on the earth was prior to the extinction of the dinosaurs. Secondly, I've never heard anyplace that the dinosaurs all became extinct because they ate each other up!

I happen to have a PhD in [... ?] and I can assure you that whenever any kind of animal is in danger of becoming extinct or has recently become extinct, we're talking about incredible uncertainties about all kinds of environmental ecological interaction and nobody ever really knows whatever happened in the case of the condors. Have they been damaged by pesticides so that their behavior has been interfered with ... are more likely to kick eggs off the nest? Is it because of the coyote hunters that killed a lot of them off some years back? Is it a species that probably was going to become extinct anyway because it was a Pleistocene thing and the habitats in that part of California that are most suitable for it were disappearing anyhow and it's a waste of time to try to save it because it has very little to do with man except we may be speeding the process up by a few years. Nobody really knows. I mean, you go to ten different specialists, you get ten different answers. So this degree of certainty that you say that we have about what's happening at present ain't so.

Audience: [Another member of the audience commented on a recent article in Science on the extinction of the dinosaurs and nuclear winter. My tape of those comments was unfortunately too difficult to understand. --- S.K.]

Dr. Brown: Can I make a remark, not about the hypothesis itself, but about what the original point of this is ...? What we really want to get at --- the issue is not whether we're going to sit here today and decide how the dinosaurs got extinct nor is the issue whether we have or are about to achieve absolute certainty. That's irrelevant when we are talking about science anyway. The issue is whether one can have evidence to carry out rational, coherent discussions about what happened in the past.

Note, the new hypothesis is not an announcement. It's presented with a body of evidence and it's presented to a scientific community who will then go on to access that evidence. It's not simply the same thing as somebody who happens to be a physicist or a Jean Dixon telling me what's going to happen in 1990. It's kind of confusing to match those up together.

The point is that we do have evidence about past events. We don't achieve absolute certainty about them, that's true, but we don't expect that in science anyway.

Dr. Klotz: I would certainly agree that we have some evidence. Obviously. But I don't think we can reach the certainty in our explanations that we can reach when we are able to make our observations on our time level.

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Audience (a geologist): As I look at this discussion we've had, the Religion-Science Controversy, what it seems to be is more a personality wrought condition. We addressed some of these topics earlier, but the subject has sort of digressed to whether what one person said is correct or whether what another person said is correct. I fear that what our controversy with science and religion is more a function of individual personalities than it has to do with the substance of the thing frequently.

From my geological background, I remember a dialogue between a man by the name of Werner and another man by the name of Hutton. Werner was a "charismatic" so to speak, not from a religious sense, but from a personality sense. He'd gather around him a lot of young people who really believed him --- true believers perhaps. Hutton was sort of an abrasive individual. Well, it turned out that time has shown us Hutton was correct and Werner was wrong. But the controversy lasted far longer than perhaps it should have because of the personalities involved and I suspect as we go on with this sort of thing, we digress to the personalities --- what this person says or what that person says, rather than address the issues because it becomes intensely personal when we address the issues. I think what we ought to do is be more God-like and more forgiving in the way we approach our problem solving and perhaps a lot of these other things would go away.

Audience: [Unable to hear on tape.]

Audience: I'm interested in Dr. Brown's statement or his

disposition about observation vs. theory in science. I basically think of science as being anchored in observation ... Don't you think, Dr. Brown, however, that theory must ultimately be verified by observation?

Dr. Brown: I hope I didn't say anything that would cast doubt on that. I thought I was talking first of all about observational science. Another time, another occasion I'd be glad to talk to you about theoretical science and about the interrelations between them.

The point when I was talking about observations --- the crucial point I was trying to make is that people have an image of observational science that has nothing to do with much science as it now exists, i.e., they equate observational science with the data we can pick up by our senses as we go walking down the street. My point was that that is ... way off the mark.

Take again the solar neutrino experiment I mentioned. Why was the experiment done? Because you want to test the theory. And even though the theory is believed to be solid and well-confirmed, you want to test it again and again and again and you want to test it in observation. One of the outcomes of that is that people are doing all kinds of other observations because in the course of attempts to explain this theory, explain this theoretical result --- people come up with new theoretical claims.

How do you deal with a theoretical claim in science? You go out and test it observationally. Well, all I was trying to do here is broaden this notion of "observation" --- get away from an unduly narrow notion of what observation is. Now I certainly don't mean to suggest that scientific theories rest on anything but observation. I would say also though that it's a long story --- that the observational process is much more complex than anything I have time to suggest here. People tend to have an overly simple image of what observation is. It's a very complex business and gets more complex all the time.

Audience: [Reference was made to some very elegant mathematical models that seem completely untestable by observation.]

Teacher from Michigan Christian College: I'm interested in comments from Dr. Brown and/or Mrs. Miles about the situation with the [biology] textbooks. In particular, I notice that we have a tendency to have more dogmatic statements in many textbooks and of course that's been a lot of the controversy ... and I guess I'm not only concerned about the idea that you should have equal time for creationism. That's not what I'm talking

about, but it seems that some have now gone overboard to try to make evolution as though one particular theory of internal mechanisms and so on is set in stone and I think that's a disservice to the advancement of science. And I just wanted either or both [of you] to comment on the whole idea of textbooks as indoctrination.

Dr. Brown: My response to textbooks is much the same as yours. There are lots of problems here. I think that a textbook that presents to young people a view of science that is a myth does a disservice to them and does a disservice to science. I'm quite convinced that one of the reasons why so many young people in our society become hostile to science is because they had presented to them as junior high school students and high school students an image of science which they can pick up the paper and see is completely not accurate. There is some strange notion that has a history of objectivity, e.g., --- this was referred to earlier ---- this notion that if a scientist really believes what he's doing, somehow he is not objective; if two scientists disagree, then they're not being objective. That's nonsense. That has nothing to do with the way people function, but only [?] the way scientists function. It seems to me that many people have been told a story about science gives you only the truth, that science operates by a simple procedure, there is no commitment, there is no uncertainty in science --- and then they can pick up the newspaper and instead of back-tracking and saying I was told the wrong story about science, they ... [conclude that] science is nonsense. And I think it's a serious disservice to our entire culture.

I don't see any advantage to perpetrating such myths. Now I have worse things than that to say about science textbooks. My son was in junior high school and he was home sick for a week and I went and picked up his book and worked with him. And I wound up writing letters to the school about the science textbook he had. I mean, I can understand why nobody is interested. There were no ideas in this textbook. The aim of the textbook, apparently, was what science is about is learning big words and you gotta get the word right and that's the entire emphasis in this textbook and that's appalling.

Teacher from Michigan Christian College: I think again that, related to this, is that science as it is taught throughout the schools is the search for answers. And you are a successful science student if you master the answers. There is very little concern about the process by which those answers come and involved in that there is very little concern about the doubts, the questions, the conflicts that occur within the scientific community itself.

I teach a course called Introduction to Biological Research which is for sophomore biology majors. This is the first time they are introduced to primary literature. Now can you imagine a lit course in which the first time they read Shakespeare is when they're a sophomore in college? Up until that time all they read is what people say Shakespeare said.

Now that's essentially what we have in the science textbooks. And because there is a certain amount of material which are desired to be surveyed in a field --- required that we cover in a particular semester or school year --- we eliminate everything except the answers. And therefore the student never knows any of the problems that are involved. He doesn't even know what a scientist is. I feel very strongly about textbooks too.

Dr. Brown: That's the article by Weinberg I referred to before. It would be an interesting model for textbook writers. He's a case when one of the most eminent physicists in the world is asked to give a semi-popular lecture on a public occasion and he comes to speak about origins. What he speaks about 90% of the time is, these are the outstanding problems, these are the questions, this is what we have to ask, here's where we were disappointed, here's where we have to look again. That's what I wish people would give as an image of what science is. Now he didn't say, "Here are the answers. I'm finished."

Audience: [Inaudible.]

Dr. Klotz: I share some of the really serious concerns that have been expressed here. Part of the problem, I think, is that there are many people who regard science as a body of knowledge and if that's what you regard science as, you're going to present a two-dimensional picture of it. You're gonna picture science to your students, science as we know it today, with the idea that this is the final answer --- we've got all the answers.

I think it is more important to present science as a way of coming at knowledge and I wish we could do it. I've puzzled over some of the things that Dr. Brown refers to and I really don't know how you can --- in the time allotted --- really show youngsters how the scientist works ... and I suspect that the easy thing, because that's difficult to do, is simply to present science as a body of knowledge ... I think that's bad.

Audience: [Inaudible.]

Dr. Klotz: Well, I don't think you can use science, basically, to support religion. I guess I go back again to Luther, who had very little use for apologetics, i.e., the defense of the faith by means of scientific observations or any other observations.

For instance, suppose that Noah's Ark were found on Mt. Ararat. For one thing, I'm skeptical. You aren't going to get a nickel of my money to support an expedition to Mt. Ararat to uncover Noah's Ark. But, also from this standpoint, that I don't think that's going to help --- to uncover archaeological evidence. I think in some ways it's helpful at times, but I would not want to depend on that.

Let me get back to the question that was raised --- what about is religion static, is it dynamic --- is it changing? I would have to say, that based on faith in revelation from an all-knowing and all-wise God, it has to be static. Now what can be dynamic is our understanding of that ...

Dr. Niedner: Maybe that's what Dr. Klotz means in his latest book when he says ... in talking about the differences between what creationists say and what other scientists who are not creationists say about the origin of the earth, etc.

This is not to suggest that the approaches, findings, and researches of the various academic disciplines are to be ignored in our understanding of what the scriptures say --- by no means --- they have a role. It is an important one, but it is a ministerial role and not a magisterial one. They are to help us understand scripture --- they are not to judge the Bible and its truthfulness. So what you're saying is that there is a discrepancy if you start with the scriptures and you conform what other academic disciplines say to support the scriptures. [I'm not positive I've transcribed this last sentence correctly. --- S.K.]

Dr. Klotz: No, no, that's not what I meant Fred. What I mean is that you re-examine your interpretation in the light of scientific evidence. Let's use the example that I referred to earlier of the geocentric and heliocentric systems. It was very easy, in the background of Ptolemaic science, to assume that that's what the Bible taught. I think that if you look at it from the standpoint of the Copernican theory, you ask yourself, "Is it really saying that?" And I think you come up with the understanding that the language of the Bible is common sense, everyday language. And that's what I meant when I said it is not scientific language.

When we read in our newspaper "sunrise and sunset at a certain time," these are Ptolemaic terms but we don't say that

thereby the newspaper is supporting the Ptolemaic theory as opposed to the Copernican theory. I don't know how you can communicate across the ages except by using common sense, everyday newspaper language. And that's why ... I will certainly agree that you have to be very careful that you don't tie your understanding of the Bible in with any scientific theory because the scientific theories are likely to change and then you're out on a limb and you're holding the bag.

Dr. Brown: Can I ask a question connected with that though? The original question was about the dynamism of religion. I must say, we've talked about a lot of science here and one of the things that perturbs me about this conference, especially given its title, is that there has been precious little said about most of the religions and most of the ... [I agree with this sentiment. --- S.K.]

Audience: I would like to just comment on the last comment because I do feel under no circumstances religion should be this very chauvinistic [idea] that there is one religion that is superior to all other religions and that it is the one true religion ... because there's certainly a big assumption being made when you say that the scriptures foretold the coming of Christ and so on because if you really go back in history you cannot find documented evidence for that. I mean, this is an assumption that may or may not be true. If you just start looking at any religion, you will find elements of it that are unique ... Some religions, e.g., do not claim that their people were the Son of God like the Christian religion does, but they only claim that their prophets were mortals and they were even subject to error ... and this sort of thing. I think you have such a variety of religions ... and the last thing you really need is the kind of intolerance that says that my religion is superior to your religion. This is the true religion, etc. I cannot buy that. There's no evidence to support such an idea.

CONCLUDING REMARKS.

I encourage readers who would like to correspond with the editor on comments I have made in my own paper on or those of the other speakers to contact me either by letter at Purdue University North Central, Math/Physics Section, Intersection of the Indiana Toll Road and U.S. 421 S, Westville, Indiana 46391 or by phone at (219)-785-2541, ext. 254.

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SCIENCE, CHRISTIANITY, AND PSEUDOSCIENCE

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2. The Humanist (and its offshoot, The Sceptical Inquirer, which deals more directly with pseudoscience), published by The American Humanist Association, 7 Harwood Dr., Amherst, N.Y. 14226.

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5. Acts and Facts, published by the Institute for Creation

Research, 2100 Greenfield Dr., El Cajon, CA 92021 (FREE!)

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7. Creation Research Society Quarterly, published by the Creation Research Society, 2717 Cranbrook Rd., Ann Arbor, MI 48104.

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Of course, more technical studies in philosophy of science journals, the journal of parapsychology, etc. exist. It is not my intention here to be exhaustive. Innumerable articles on creationism have appeared in the American Biology Teacher and BioScience. Similarly, many articles on religion and science have appeared in popular and technical theology magazines and journals. One might consult Christianity Today for an evangelical approach to such issues, for example.